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ABSTRACT

This series of journals includes volumes 1-4 of "Growing Ideas," a journal of garden-based learning. Each issue provides instructional ideas, horticultural information and a forum for exchange among teachers using classroom gardening to stimulate learning. Ideas in each issue are separated into three sections. The "Green Tips" section presents articles related to gardening and activities that encourage student investigation. The "Exchange" section contains letters from readers that share teaching ideas, information about local projects, and responses to prior issues. The "Resources" section reviews instructional materials and provides information about resource availability. Among the topics discussed in these issues are: the National Aeronautics and Space Administration's (NASA) SEEDS project, peanuts, lunar harvest, hydroponics, biospheres, energy, ponds, ladybugs, herbs, worms, transplanting, mathematical problem solving; bulbs, global gardening, butterflies, compost, and wildflowers. (MDH)

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A JOURNAL OF GARDEN-BASED LEARNING

Growing Ideas

Published by the National Gardening Association

Volume 1, Number 1, Fall 1990

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Welcome to *Growing Ideas*

Whether you're raising plants on a windowsill, or using a GrowLab Indoor Garden or home-built version, we hope this newsletter will help spark new ideas and alliances. Teachers across the country are developing an exciting range of lesson plans, thematic projects and strategies for using classroom gardening to stimulate learning.

While some of you use the indoor garden to teach life science units on plants, others use it as a centerpiece for thematic or whole language projects--studying habitats, other cultures, nutrition, and weather. You raise kiwi, pansies, grow seeds from space, simulate rainforests, start wildflowers. You integrate indoor gardening with Math Their Way. You've developed a range of means for getting donations of seeds, soil, pots, and for involving classroom volunteers in your gardening projects.

We'd hate to see such a creative batch of ideas languish in individual classrooms. Responses to an indoor gardening survey this spring indicated that you, too, would appreciate a forum for sharing ideas with other indoor gardening classrooms. *Growing Ideas* can be that forum.

We'd like to highlight your lesson, project and classroom management ideas in the "Growing Ideas Exchange" column. Using this column, your class could also locate garden pen pals or exchange special seeds, videos, or experimental data. We encourage you to advertise such requests in our "Growing Ideas Exchange."

Have your cukes been lacking for female flowers? Have your beans turned slimy? The "Green Tips" column offers horticultural advice and recommendations for indoor classroom gardeners. It also highlights horticultural ideas and news that provide classroom teaching opportunities.

The "Resources" column features written and material resources that can support your indoor gardening efforts. We welcome suggestions, reviews and descriptions of both fiction and nonfiction books.

Growing Ideas will also include articles on such topics as fund-raising or using different teaching methods (e.g., cooperative learning) with your indoor garden. Although we primarily feature ideas for indoor garden-based learning, we're eager to hear and write about your outdoor school gardening experiences.

To ensure that *Growing Ideas* is a useful resource for educators, we need to hear from you. What are your interests, needs, successes, concerns? Please take a few minutes right now to fill out and return the enclosed response form. If you don't have the time or inclination to fill out the survey, send us at least your name and address to ensure that you'll receive future copies of *Growing Ideas*. Then, enjoy reading this first issue. We hope it will provide some fertile ideas.

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Share your growing ideas!

We invite you to send your activity ideas, classroom management suggestions, gardening questions, resource recommendations and special requests to: Growing Ideas Editor, National Gardening Association, 180 Flynn Avenue, Burlington, Vermont 05401.

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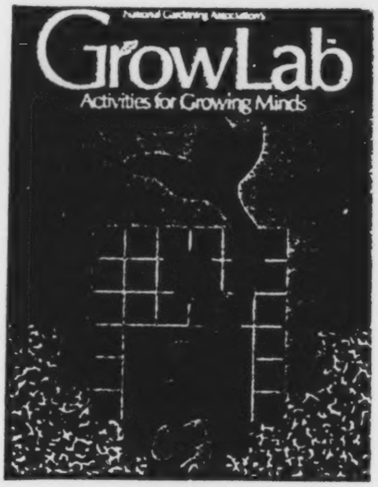
GrowLab: Activities for Growing Minds

Students in indoor gardening classrooms nationwide will soon "get hooked on worms," discover what makes a fruit a fruit, and "journey to the center of a seed." They'll be challenged to simulate tropical rainforests, uncover mystery family ties, and grow their own fungus!

These explorations will be sparked by our new K-8 curriculum activity guide, *GrowLab: Activities for Growing Minds*. A year and a half ago, we invited 13 enthusiastic teachers to help us design garden-based activities to foster hands-on classroom science. Our challenge was to develop engaging activities that incorporated key life science and environmental topics, encouraged students to use their senses and minds to explore the natural world, and enriched other subject areas.

During the spring and fall of 1989, more than 120 indoor gardening teachers throughout the country tested those activities in their classrooms and gave us helpful feedback and suggestions. Their comments confirmed our hopes that the activities stimulated thinking, questioning, and learning, while being a great deal of fun. Those activities became the core of this new 320-page guide.

GrowLab: Activities for Growing Minds encourages you, the teacher, whether new to gardening or a confirmed green thumb, to be a co-explorer with your students. "I knew very little about worms," wrote a teacher from Missouri, "but your suggested questions and background information helped me to guide students as they made their own discoveries, and we all learned a lot in the process."


National Gardening Association's
GrowLab
Activities for Growing Minds

While the activities draw on students' natural curiosity to explore life science and environmental concepts, they also help you breathe life into other subjects. After all, what better way to practice math than by graphing your plant's response to fertilizer, or to learn about social studies than by exploring the history of the potatoes you're growing? Some, such as "Fruit for Thought" can be completed during one class session, while others, such as "Make Room for Raddy" require longterm observations and recordkeeping.

Some activities, such as "Petal Attraction" and "Why Root for Roots?," help students explore the amazing adaptations that enable plants to survive. Others, such as "Mystery Family Ties," invite students to explore how humans make sense of the diversity of life on earth. Activities in the chapter "Sharing the Global Garden" highlight the interdependence of plants and other living things.

Each lesson encourages questions and challenges that require students to observe, reflect, and apply their understanding to new situations, rather than merely repeat facts. A class might review and discuss experimental findings, debate the merits of acid rain legislation or map out a "What would happen if...?" web on one of the 30 reproducible worksheets.

A teacher from Virginia wrote, "The 'Pollution Solutions' lesson was a great springboard. After designing their own experiments and discovering the effects of many common substances on plants, my students researched alternatives to household pollutants. The exercise helped them clarify their feelings about their ability to make a difference."

The annotated resource section in *GrowLab: Activities for Growing Minds* describes a range of fiction and nonfiction books for students and teachers. The seed resource section will tell you where to find seeds of such unusual items as peanuts, cotton, trees or carnivorous plants.

GrowLab: Activities for Growing Minds contains samples of activities to stimulate garden-based learning with different grade ranges. We hope they will inspire you to adapt them and to develop new ideas to fit your unique classroom needs.

To order a copy of *GrowLab: Activities for Growing Minds*, send $19.95 plus $3.00 for shipping and handling to: National Gardening Association, Dept. GI, 180 Flynn Avenue, Burlington, VT 05401.

Growing Ideas is published three times a year by the Education Programs Department of the National Gardening Association. *Growing Ideas* provides instructional ideas, horticultural information and a forum for exchange among teachers using classroom gardening to stimulate learning.

For a complimentary issue of *Growing Ideas*, write to: *Growing Ideas*, National Gardening Association, 180 Flynn Avenue, Burlington, Vermont 05401.

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Growing Ideas

Exchange

Highlights from Green Classrooms

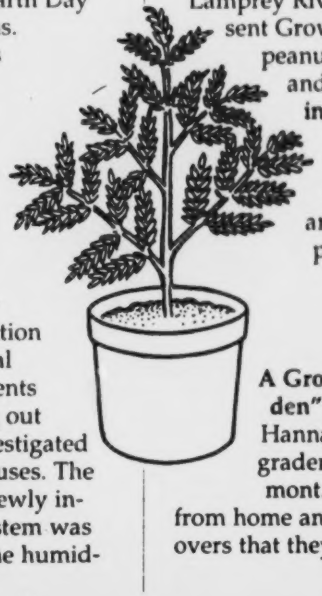
While talking with teachers around the country, we discovered a range of creative ways in which indoor gardens are being used and supported. To help spark your own imaginations, here is a smattering of highlights from their classrooms.

Fourth graders in Donna Hattaway's class in Carson City, Nevada, had such success with their 45-day salad that they were able to serve more than 60 kids! For mother's day, the class grew phlox, marigolds and nasturtiums. Donna reported that these flowers grow well indoors -- perhaps too well. The children learned a lesson in competition as the nasturtiums grew out of bounds and threatened to take over the GrowLab. Donna was too late to receive tomato seeds from NASA's SEEDS program, and would welcome a donation of seeds from space saved by other classes. Send seeds to: Donna Hattaway, Fremont Elementary School, 700 East 5th, Carson City, NV 09703.

* * *

Vallarie Henderson's fourth grade class in Cincinnatti, Ohio, uses the GrowLab as a springboard for studies across the curriculum. To fulfill a language requirement in persuasive writing, students in Vallarie's class write letters to parents and local businesses highlighting the value of an indoor gardening experience, and soliciting materials to help support their gardening efforts. Science units on weather and plant dormancy include forcing bulbs in the indoor garden. A study of leaves lead to making solar leaf prints on photographic paper. After observing and dissecting flowers they'd grown and collected, students used fabric paints to design their own lively flower t-shirts, complete with labels to exhibit their new understanding of flower structure and function.

* * *



Don Sondag's fourth and fifth graders in Sparks, Nevada decided to raise honey locust seedlings in their classroom using materials from "Trees for Life, Inc" (see page 8 for ordering information). The students transplanted the tree seedlings in their community during Earth Day and Arbor Day celebrations. During the summer, Don's students partipate in his "Green Thumb Program" by taking home and caring for GrowLab raised plants. Students receive a Green Thumb award for plants brought back alive in the fall.

Don reminded us how important it is to pay attention to classroom environmental conditions. When his students noticed their plants drying out faster than usual, they investigated and discussed possible causes. The class discovered that the newly installed air conditioning system was responsible for lowering the humidity in the room, and they had to adjust their plant care routine accordingly.

* * *

Pat Pierce's fifth graders in Bristol, Vermont used their indoor garden as a centerpiece for studying herbs. While students' herbs matured, they researched medicinal and culinary uses, history and folklore. "Students were quite excited to be able to identify their herbs in different reference books," said Pat. "*Rodale Encyclopedia of Herbs* was our favorite." Beautifully illustrated herb recipe books were a Mother's Day highlight. They included information on caring for herbs and tips on medicinal uses as well as student-located recipes. Pat's class would love to exchange herb recipes with students in other classrooms. Write to: Pat Pierce, Bristol Elementary School, 57 Mountain St., Bristol, VT 05443.

* * *

"Our GrowLabs have created great opportunities for exchange among students throughout the country," said Rod Crepeau, principal of Lamprey River Elementary school in Raymond, New Hampshire. Last year, students at Lamprey River sent proceeds of a Christmas penny collection to a school in Sumter, South Carolina which had been damaged by hurricane Hugo. The southern students, on learning of Lamprey River's indoor gardens, sent GrowLab students seeds of peanuts, cotton, soybeans and sunflowers--all **grown in their area. Students** corresponded and learned about agriculture, lifestyles, and people in an other part of their country.

* * *

A GrowLab "garbage garden" was the choice of Hannah Morvan's first graders in Northfield, Vermont. They brought items from home and chose lunch box leftovers that they thought might grow

continued on next page

in the indoor garden. Potatoes, carrots, avocado pits and fruit seeds all developed into thriving classroom plants!

* * *

Jeff Brohinsky in Hartford, Connecticut, is well-known in indoor gardening circles as the teacher whose fourth grade classes have grown and milled cotton, and simulated rainforests and desert climates in their three GrowLabs. This year, with the help of a volunteer from a local business, Jeff's class covered one GrowLab with plexiglass and turned it into a giant woodland terrarium, complete with flowers, tree seedlings, mosses, mushrooms and snakes. "The kids have trampled over and never noticed these same things in parks near the school," said Jeff. "Now that they've had a chance to carefully observe them in the class, they're paying more attention to living things outside."

* * *

"My students used to have a hard time being motivated to write in their journals," commented Patrice Luneau, third grade teacher in Hardwick, Vermont. "But since we've been gardening indoors, there's always something that catches their attention and compels them to write." Patrice's class integrates the indoor garden into an interdisciplinary "wellness" theme. They raise and eat their own healthy food and conduct experiments with light and other factors, tying in an understanding of both plant and human needs.

Power Plants!

The National Gardening Association is developing a new curriculum guide for teachers in grades three through five. The guide will contain garden-based activities to help students explore the basic principles of energy (e.g., sources, uses, conservation). If you've developed materials or know of resources that help teachers make connections between plants and energy, please contact: Joy Cohen, National Gardening Association, 180 Flynn Avenue, Burlington, Vermont, 05401. Thanks for sharing your time and energy!

* * *

Craig Yager's fifth grade students in Boulder, Colorado, had hands-on practice in running a business while earning enough money to cover the cost of their classroom GrowLab. Students planned, grew plants for and conducted an Earth Day plant sale in the neighborhood. Each small group of students researched and carried out a different aspect of the business including advertising, finances and raising healthy plants. The plant sale, held on Earth Day in front of the school, was a financial, educational, and emotional success!

On a musical note, Craig recommends playing selections from Stevie Wonder's album, "The Secret World of Plants" to complement your indoor growing efforts. Many of the lyrics will spark discussion and thought about different perspectives on living things.

* * *

We were pleased to receive a copy of an exciting school publication, *Growing Children's News*, from Salisbury Central School in Connecticut. This illustrated newsletter, full of students' prose and poetry, highlights indoor and outdoor growing experiences. The newsletter is shared with parents, garden club volunteers, and businesses who have provided materials and services to support the students' gardening efforts. One of the highlights, reported some first graders, was raising herb, flower and vegetable seedlings in the GrowLab and transplanting them to outdoor beds at the Noble Horizons nursing home. First and second graders received a $1,000 KidsCare award from "Scholastic News" for this intergenerational partnership.

* * *

Kathy Romasco, a third grade teacher from Sutton, Massachusetts, shared that she had some initial trepidation about indoor gardening. "When I first started I thought, Oh, I don't have the background for this--I know questions will come up and I don't have the answers. But I found that it was easy to encourage the kids to come up with their own ideas. The seeds grew, and I had kids work in small groups to plan and discuss experiments. They came up with lots of their own conclusions, and we all learned something in the process!" Kathy recommends starting out with simple explorations and observations, allowing students to experience the joy of watching and communicating about growing things. Once you and they are comfortable with this, you can move into more controlled scientific studies.

Some students from Alan Campo's seventh and ninth grade classes in Lewes, Delaware, decided to share their exciting NASA seeds project with a broader audience. Students received permission to set up a GrowLab display at a local shopping mall, complete with flyers describing the experiments they'd be conducting with the seeds from space. "The kids were really proud of the display," said Alan, "and they had great interest from the crowd." (For more on tomato seeds from space, see the following article.)

TAKE ME TO YOUR WEEDER!
MOM, DO I HAVE TO EAT ALL MY VEGETABLE?
A
C
NASA SEEDS

Space Seeds Spark Young Scientists

They haven't grown any mutant ninja tomatoes yet, but we're keeping our eyes on indoor gardening classrooms participating in NASA's SEEDS program. During the spring of 1990, more than 100,000 classrooms nation-wide received tomato seeds that had been orbiting in space for six years. When NASA and Park Seed Company sent the 12.5 million seeds up in the Long Duration Exposure Facility (LDEF) in 1984, they planned to bring them down a year later. But NASA was unable to retrieve the seeds until last December. This offered students and other scientists a rare opportunity to examine the effects on living tissue of longterm exposure in space.

Classrooms participating in the SEEDS project received kits of space-flown tomato seeds and control tomato seeds that had been stored on Earth for six years. NASA has asked them to keep and return records of basic observations and experimental data. Scientists are particularly interested in mutations that might appear in subsequent generations, due to the radiation the seeds received.

Students in SEEDS classrooms have enjoyed letting their imaginations run wild as they make predictions about the possible mutations of the space-exposed tomatoes. They predicted such outcomes as dramatic changes in growth rate, size, and color. Some even hypothesized that space tomatoes would sprout antennae!

What have these classroom scientists discovered? "Well," said Doris Morris, a fifth grade teacher from Wilmington, Delaware, "we haven't yet discovered any differences between seedlings of the space-flown seeds and those of the earth-based seeds, but the process has been very exciting for my class." Her class decided how to set up the experiments, which included growing earth-based and space-based seeds in the GrowLab, on windowsills, and under red cellophane to see the effect of only red light on the plants.

Once the class was satisfied that they had controlled variables except the type of light for each kind of seed, they observed the pots for signs of germination. When the plants on the windowsill began to germinate before those in the GrowLab in the basement (left there to keep out daylight), students questioned the difference. Doris explained, "In reviewing the experiment, students realized that they hadn't really controlled all variables, since the temperature on the windowsill was much warmer than in the basement. It was a wonderful opportunity to reinforce the students' understanding of the science process."

The SEEDS project has become a springboard for breathing life into all subjects. Students graphed and measured their plants and kept careful records. They wrote tomato books and recipes, dissected tomato flowers, and had schoolwide "tomato days. "

The jury's still out as to how and if tomato seeds were altered as a result of their space travel. Most seedlings were sent home with students or kept in school gardens during the summer. Many teachers plan to collect and save seeds from this year's crop, so the second generation tomato plants can be raised in classrooms this fall.

The beauty of a project like SEEDS is that it helps teachers engage students in science exploration that sparks young imaginations, and is part of real-life problem solving. Teacher Jean Kraeuter remarked, "It's been such a valuable lesson for the students. It made them conscious of the part they were playing in a much larger experiment." We're eager to hear from more teachers about garden-based projects that involve students in exploring real-life questions and problems. Please share your experiences with us.

We've heard from a number of teachers who were unable to receive seeds from space due to NASA's limited supply. Classrooms that did raise space tomatoes should be able to harvest a bumper crop of second generation space tomato seeds, since tomatoes produce seeds in abundance. If you've participated in the SEEDS project, and have seeds to spare, please let us know. We'll publish your address in the next issue of *Growing Ideas* so other classrooms can contact you.

Saving Tomato Seed

The best time to harvest tomato seeds is when the fruits are fully ripe, and even a bit overripe. The easiest method is to scrape the seeds out with a fork and let them dry for a couple of weeks on a piece of waxed paper. Remove seeds and store them in a tightly covered jar or small plastic bag until they're ready to be mailed or used.

Growing Partnerships

Garden Club, Garden Club
How nice you are.
Planting near and planting far.
Digging, gardening, putting in seeds,
Earth saving--a very big deed.

—by Danny Cahill, grade 3, Salisbury Central School, Connecticut

Throughout the country, exciting partnerships continue to grow between gardening classrooms and individuals, organizations, and businesses wishing to support garden-based learning. In Indianapolis, the Garden Project of the local Cooperative Extension applied for a Chapter 2 grant to build 50 GrowLab Indoor Gardens. A high-school industrial arts class built the gardens, and Master Gardeners from Cooperative Extension helped train elementary teachers and regularly visit classrooms to do special activities. Parent/Teacher Organizations throughout the country are providing funds to purchase indoor gardens and materials.

The possibilities are endless. These types of partnerships not only help financially, but offer a great opportunity for an exchange between generations, fresh classroom ideas, and community understanding of school needs. Some of the groups to consider approaching for gardening program assistance include:

Garden Clubs - Local garden club chapters may be willing to provide funds for the purchase of indoor gardens or materials, or conduct special classroom projects or activities. Consider appealing to a local group to "adopt" your classroom. To find out if there are garden club chapters in your area, contact: National Council of State Garden Clubs, 4401 Magnolia Ave., St. Louis, MO 63110 and Men's Garden Clubs of America, 5560 Merle Hay Road, Johnston, IA 50131.

Cooperative Extension - The Cooperative Extension Service, in nearly every county in the country, has a wealth of written horticultural information and advice. Many Extension offices have Master Gardener programs to train community members in horticulture who, in turn, are required to volunteer in the community or schools. 4-H leaders, representing the youth arm of Cooperative Extension, can also be good support for school gardening programs.

Parent/Teacher Organizations - Don't overlook your Parent/Teacher Organization's vital link to the classroom. Most school PTO's are committed to raising money to support school programs. PTO's are often eager to locate innovative programs and to find projects in which to involve parent volunteers.

Botanical Gardens, Arboreta, Environmental Centers, Science Museums - Many of these types of organizations have educational programs and materials that can support indoor gardening efforts. Some provide teacher training, gardening materials and indoor garden unit loans to interested teachers. Check with such groups in your area to find out what garden-based educational materials they have, and to let them know about the GrowLab Program.

Local Businesses (nurseries, garden centers, hardware stores, etc.) - Don't be shy about approaching local businesses to donate materials or volunteer time in your school gardening program. Contributing to local education by supporting a school gardening program can be a good community service, an investment in future consumers, and an effective advertisement. Garden centers, nurseries, and variety stores often have a surplus of seeds and garden supplies to clear out toward the end of the season, just when your school garden is beginning to sprout.

Large local businesses may offer grants to teachers to purchase special science programs or equipment. Some have established business-school partnerships in which employees volunteer time in classrooms. Utility companies in Vermont, concerned about energy conservation, have initiated GrowLab Grants Programs. We'd be glad to supplement your efforts by sending materials to help you "state the case" for indoor gardening and by helping large businesses develop programs to support multi-classroom GrowLab efforts.

Other Potential Partners - We've also heard of successful partnerships between gardening classrooms and the following types of groups:

- Public Education Funds
- School Science Clubs
- Community Gardening Groups
- City Departments (e.g., soil and water conservation, landscaping)
- Service Clubs (e.g., Kiwanis)
- Local Church Groups
- Universities
- Future Farmers of America (FFA)
- Industrial Arts Classes (for building indoor gardens)

We'd like to hear about your growing partnerships! Have you discovered any creative ways to fund or involve the community in your gardening project? Your success stories can help other teachers and help us develop materials to help community sponsors better meet teachers' needs. Also, please let us know of groups you think would appreciate a copy of our sponsor's guide titled,* GrowLab: Building Community/School Partnerships Through Indoor Gardening. *This 30-page guide offers a planning framework for groups initiating and supporting a multi-classroom GrowLab effort.

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Green Tips

In a Pickle Over Cukes?

We've heard from a number of teachers who have experienced "cucumber confusion" in their indoor gardens. "The plants were growing beautifully," remarked one fifth grade teacher. "The students were caring for them and patiently awaiting the arrival of flowers so we could pollinate them ourselves. But we only found male flowers."

Cucumbers are one of the few plants you'll raise in the indoor garden that will require your help with pollination. To avoid cucumber confusion, it's helpful to understand a few things about the sex lives of cucumber plants. Cucumbers have imperfect flowers -- that is, each flower is either a male or a female. Typically, a cucumber plant will produce both types of flowers. In nature, pollinators such as bees are required to transfer pollen from the male flowers to the female flowers for fertilization and fruit production to occur. In the classroom, you and your students play pollinators.

Many garden varieties of cucumbers grown indoors will develop a lot of male flowers early in their growth. These appear in clusters where the leaves join the stems, on short stalks. Female flowers tend to appear in later stages of the cucumber's life. You'll recognize them as female flowers because of the mini-cucumber joining the flower to the stem. Invite your students to use hand lenses to carefully observe, count and distinguish between male and female flowers.

Since successful pollination can only occur when male and female flowers are around at the same time, you have a couple of alternatives. One is to simply nurture your plants, keep them healthy, and be patient. You're bound to get a female flower or two while male flowers are still available. The other alternative is to plant cucumber plants a month apart so male and female flowers will likely be around at the same time. The cucumber variety Bush Champion, included in the GrowLab seed collection, should produce a balance of male and female flowers.

One of the secrets to successfully pollinating cucumbers is to transfer pollen when both male and female flowers are mature and ready for pollination. The male flower should be fully open with the velvety, bright yellow cushion, formed by the anthers, showing. The style of the female flower, when mature, should have turned from a bright green disc in the center of the flower, to a larger, bright yellow, convoluted surface.

Page 53, in *GrowLab: Activities for Growing Minds*, illustrates both types of flowers and describes how to pollinate cucumbers. If your pollinating attempts are successful and the plant is healthy and prepared to put energy into raising fruit, the miniature cucumber at the end of the flower will continue to grow.

Resources

Free Seeds

Operation Green Plant at the America the Beautiful Fund wants to support civic, charitable and educational gardening programs by offering free vegetable, herb and flower seeds. They are particularly interested in projects that emphasize raising plants to grow food for the needy, for charitable plant sales, to beautify neighborhoods, to share with the elderly or handicapped, and to teach children the joy of caring for plants.

To order a set of 50 mixed packets, send $4.95 for postage and handling to: America the Beautiful Fund, 219 Shoreham Bldg., Washington, DC 20005. Be sure to include your name, address (for UPS delivery), phone number, and school or project name. If you want more than 50 packets (up to 750) you must add an additional $4.00 per 100 packets and attach a short description of your gardening project, highlighting how the seeds will be used and/or shared. There is a limited supply of free seeds, so get your requests in soon!

Tree Seeds

Trees for Life, Inc. has a tree planting kit and educational materials to help teach elementary students the role of trees in the ecological balance. The honey locust seeds they offer will grow well in GrowLabs, can be transplanted outdoors throughout the country, and can be used for the activity "Global ReLeaf" in *GrowLab: Activities for Growing Minds*.

A kit costs .50 per child plus $2.50

continued on next page

postage and handling for the entire order. The kit includes a biodegradable planting container and several seeds per child. A teacher's workbook includes instructions and classroom activities. Orders require four weeks to process. Order from: Trees for Life Seed Kit, 1103 Jefferson, Wichita, KS 67203.

Books

Tomato, by B. Watts. Englewood Cliffs, NJ: Silver Burdett Press, 1989. 24pp. $6.96.

Sharon Levin, an experienced school librarian, recommends this book for indoor gardening teachers. It's particularly timely for classrooms raising tomato seeds from space! Aimed at grades K-3, with short simple sentences on the left hand pages and full color photographs on the right, this book portrays the growth of one tomato plant from seed to fruit. The text encourages the reader to notice specific details. The photos are exquisitely clear; you can see the tiny, shiny fuzz on the tomato skin. This is one of the Stopwatch Books series, which also includes books about beans, ladybugs, potatoes and spiders. (Recipes, history, projects and gardening tips are not included.)

Videos

"Rainforest Rap" Video

Some classrooms have used the indoor garden as a context for exploring tropical rainforest habitats and learning about the promise and problems of these tropical treasure chests. The activity "Rainforest Stories," in *GrowLab: Activities for Growing Minds*, lists resources to complement rainforest studies. An additional resource is a 6-minute "Rainforest Rap" video produced by the World Wildlife Fund. This upbeat rap offers students an image of tropical rainforests, highlights some important rainforest issues, and adds suggestions for how kids can help.

To order, send $15 plus $2 for shipping and handling to World Wildlife Fund, PO Box 4866, Hamden Post Office, Baltimore, MD 21211. For $29.95 plus $5 shipping and handling, you can receive the video, two rainforest posters, and a teachers' manual with lesson plans.

Growing Ideas

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Growing Ideas

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Upcoming Issues — Share your Growing Ideas

- *"I never knew tomatoes came from plants before," remarked one enthusiastic second grader. Classroom gardens can be springboards for teaching about food, nutrition, agriculture and world hunger. If you have used your classroom gardening experience to help students explore these areas, please use the enclosed survey to tell us about it. We may want to highlight your efforts in an upcoming issue of Growing Ideas.*

- *Raising and planting trees can underscore lessons on global warming. Trees serve as homes for wildlife, windbreaks, shademakers, and food sources. They can become a backdrop for studies across the curriculum. Have you tried raising tree seedlings in your classroom? Please use the enclosed survey to share your stories with us.*

GrowLab Video

This fall, students in Ohio, Connecticut and South Carolina combined their enthusiasm for indoor gardening with newly learned communication skills. Directed by our staff and videographer, Stu McGowan, more than one hundred elementary students helped produce a 10-minute video that captures the essence of garden-based learning.

From environmental commercials to dramatic scenes of personified plants, students showed us what they thought about learning science through GrowLab activities. These enthusiastic actors contrasted previous science experiences ("My eyes got watery from too much reading") with their GrowLab experience ("I get to ask lots of questions and try to find out the answers"). Interviews with teachers, principals, and other adult supporters presented the adult perspective on using GrowLab to stimulate hands-on learning.

The resulting video is now available in VHS format. "GrowLab: A Growing Experience" portrays the same excitement and enthusiam for learning that the GrowLab Program promotes. It helps viewers visualize how a plant-based curriculum can engage students, and elegantly helps 'state the case' for hands-on, garden-based learning.

If you want to inspire other educators to try indoor classroom gardening, or want to convince your PTA, school administrators, or other potential funders and supporters of its value, "GrowLab: A Growing Experience" is the tool to use. To borrow the video, send $5.00 for postage and handling to "A Growing Experience," National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.

Notice: We've had so much fun with this first video, that we're looking for GrowLab classrooms to work with us in January on two teacher-training videos. If you'd like to get involved and if your students have used a video camera, contact Joy Cohen, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.

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Getting Help: Master Gardeners

We've heard from indoor gardening teachers, "All of our bean leaves are dropping off—what could be wrong?" or "Do you know any activities with flower bulbs that I can use with my first graders?" Master Gardeners are a national network of resource people who can help answer these types of questions and enrich your classroom gardening effort.

Many of the Cooperative Extension offices (found in nearly every county in the country) have Master Gardener programs which offer extensive (40-120 hour) horticulture training to community members. In exchange, these gardeners agree to use their new horticultural expertise as volunteers in their communities.

Caroline Kiang, a Cooperative Extension horticulturist, trains Master Gardeners in Suffolk County, New York. When she receives requests for horticultural assistance from schools and other groups, she often matches them up with one of the "experts" she's trained.

Caryn Popowitch went through the Suffolk County program and has been helping out in schools ever since. She started in her children's school with a school beautification project, then encouraged the PTA to donate a GrowLab Indoor Garden. Using her Cooperative Extension and community connections, Caryn has brought new resources and project ideas to the gardening teachers in the school. The program has been so well received that the PTA agreed to buy more GrowLabs.

Caryn visits the GrowLab classrooms once each week to help teachers with special projects and problems. Herbs were the focus for one semester. Students grew catnip, basil, thyme and rosemary from seeds and cuttings. They made herb window boxes which were raffled off at "grandpersons" day. Herb vinegars, pot pourris, herbal recipes and herb folklore, and even catnip mice followed. When students found a recipe for a 'cure for baldness' in a resource book, they tried some of their own herbal alchemy!

Said special education teacher Nancy Hall, "It's been wonderful having Caryn's support. I had never done classroom gardening before. I've learned so much from her, and we're able to combine my teaching strategies with her horticultural knowledge to produce some really nice projects. Caryn's connections got us involved in exhibiting at a local ecology center. My students developed displays about their indoor gardens -- were they proud!"

To learn more about Master Gardener Programs in your area, contact your local Cooperative Extension Office. To find them, look under "Cooperative Extension" or under the name of your county in the phone book.

Partner Update

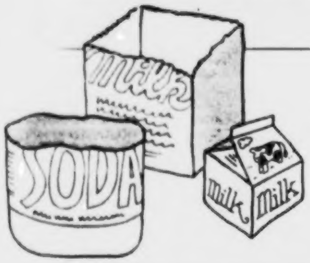
The September issue of *The Rotarian*, the national magazine of Rotary Clubs, described the GrowLab Program. Since then we've spoken with a number of teachers who have approached their local Rotary Clubs for donations of money, materials and/or volunteer time to support their GrowLab Programs. The clubs are particularly interested in the environment. Consider approaching your local Rotary with ideas on how they might support your indoor gardening effort. Be sure to tell them how garden-based learning helps build environmental awareness.

In each issue of Growing Ideas, we will highlight one type of community/school partnership. Your success stories can help other teachers and help us develop materials to help community partners better meet teachers' needs. Let us know of any partnerships that are growing within your program.

Container Recycling

Although your indoor garden may have started off with an adequate supply of containers, they do tend to disappear over time. Kids take plants home, some plants are sold, others given away, and pots are broken. Use the opportunity to involve your students as garden recyclers. Remember to be sure that all containers have drainage holes in the bottom. Consider using such items as:

- ***1- or 2-liter soda bottles (with tops removed)***
- ***egg cartons (only for very young seedlings)***
- ***plastic "deli" containers***
- ***milk cartons of all sizes***
- ***yogurt containers***
- ***used paper cups***
- ***plastic jug bottoms***
- ***(Add your own ideas and tell us so we can let others know!)***



Growing Ideas is published three times a year by the Education Programs Department of the National Gardening Association. *Growing Ideas* provides instructional ideas, horticultural information, and a forum for exchange among teachers using classroom gardening to stimulate learning.
For a complimentary issue of *Growing Ideas*, write to: ***Growing Ideas*, National Gardening Association, 180 Flynn Avenue, Burlington, Vermont 05401.**

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Successful Seedlings

If your class is planning to raise seedlings to plant in the school garden, for a beautification project, to sell, or to take home for family gardens, it will soon be time to start indoor seedlings. Raising seedlings offers a good opportunity to practice reading and language skills (most seed packets contain planting instructions), math skills (e.g., using seed packet information to determine when to plant or figuring germination percentages), and many science process skills (e.g., predicting germination, measuring growth rates or inferring why seedlings are leggy).

Many gardening books and pamphlets provide good information on starting seedlings indoors, so we won't go into great depth. Some key reminders follow:

Thyme
Marigolds
ABC SEED CO.
GREEN THUMB CO.

- **Decide what to plant**. Root crops such as carrots and beets don't transplant well, nor do beans and peas. Squash, cukes, and melons have tender root systems, but can be transplanted from individual containers if done so with little root disturbance. Crops like tomatoes, peppers, broccoli, cauliflower, and most annual flowers transplant well. Sarah Woodhead, a second grade teacher in Vermont, sends her students home with a list of vegetable and flower seedlings. Parents check off which seedlings they'd like for their gardens.

- **Find out the last spring frost date** in your area from local gardeners or from the County Cooperative Extension service. This will help your students figure when to plant each type of seed in the classroom. Plants such as tomatoes, peppers, eggplant, squash, cucumbers, and melons should not be planted outside until after the danger of frost is past. Plants such as broccoli, cabbage, lettuce, parsley, and onions can be put outside when the soil is still cool. Flowers vary, so check your seed packets. The table on page 24 in *GrowLab: A Complete Guide to Gardening in the Classroom* lists how many weeks before transplanting each type of seed should be started.

- **Give seedlings adequate light.** Young seedlings grow rapidly and require 14-16 hours of light for best growth. Keep your lights 2-4 inches from the plants at all times. If they're on a windowsill, rotate plants regularly. If your seedlings look tall and "leggy," they are probably not getting enough light, or are getting too much fertilizer and heat.

- **Fertilize seedlings every 10-14 days** with whatever you're already using in the GrowLab. Water them thoroughly when they're dry to the touch one inch down.

- **"Harden off" your seedlings** before putting them in soil outdoors. (See page 24 in *GrowLab: A Complete Guide to Gardening in the Classroom* for information on hardening off.)

Exchange

Cross-Grade Garden Tutors

Beth Garver's fifth graders in Effingham, South Carolina have learned about more than just plants using GrowLab. They've discovered the challenges and rewards of sparking young minds. In addition to conducting their own indoor gardening investigations, these fifth graders cooperatively plan, conduct, videotape, and critique science lessons with a first grade class of indoor gardeners.

Before Beth's class meets with their first grade charges, they review an investigation from *GrowLab: Activities for Growing Minds*. These fifth graders work in groups of six to decide how to set up the lesson for younger children. Their goal is not simply to present the lesson, but to draw out younger students' ideas, predictions, and observations without giving them the answers.

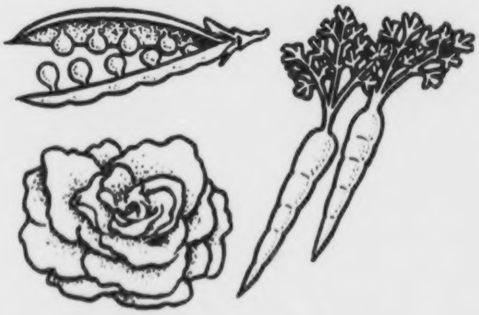
One group of fifth graders at a time develops and conducts a hands-on lesson with the younger children. Throughout the year, fifth graders rotate through different roles in their teaching groups. Each group contains one video camera person, one "instructor," and four assistants. As the student instructor elicits questions, predictions and observations from the first graders, assistants prompt individual groups of first graders and write all responses on large paper. The designated camera person films the entire process.

Once these tutors help the first graders set up their hands-on investigation, the fifth graders are responsible for overseeing the recordkeeping phase. They must visit their young charges at eight each morning before class begins to see that first graders make their daily observations. At the end of the exploration, the "instructors" have a follow-up session to help the younger students make sense of the exploration. "In order to teach others and facilitate lessons, my kids have had to develop a firm grasp of the subject matter," Beth says.

Back in the classroom, these older students watch videos of their lesson presentations and follow-up. They provide feedback to one another on teaching style and on the young students' response to the lesson. Beth feels that this is a real highlight of the effort. "Seeing themselves in action provides very useful feedback, and can be a great deal of fun. Kids learn a bit about how to become more dynamic presenters. The first graders think they're absolutely marvelous—the boost in self esteem in my class is quite obvious."

Boston teacher Sandy Arjune also pairs younger and older students in the garden. Her fifth graders invited a first grade class to participate in a salad growing project. During the nine-week project they grew lettuce, carrots, tomatoes, chinese cabbage, and cukes. They experimented with nutrients by regularly fertilizing one of each type of plant, and leaving one unfertilized for comparison.

When first graders visited once a week, students broke into small mixed-grade groups. Each was assigned a particular vegetable to plant and care for until it matured. "We found it very useful to tightly structure the initial planting session," said Sandy. "We literally had one kid holding the container, one pouring in the potting mix, one getting the seed, one measuring the depth in centimeters, and so on."



The fifth graders had to keep detailed journals of all observable changes in their plants. When the first graders came each week, their fifth grade group-mates helped them articulate their observations and write in journals. The older kids also helped them fill in individual growth graphs, thin lettuce plants, and hand pollinate cucumbers.

Sandy agrees with other teachers about student gains from cross-grade learning "My students improved in their abilities to structure sentences, write, and graph in order to coach the younger kids. Perhaps most important was their learning more about the value of cooperation as they tried to keep the first graders on task. I think it gave them a better idea of what I ask from them in terms of cooperation, quiet, and attention. They emerged with an increased sense of responsibility and a nice tast of adulthood."

Classroom to Classroom

Thanks to those of you who returned the survey from the last issue and filled us in on how you are integrating gardening into your classrooms and curricula. Many of you expressed interest in hooking up with other classes to locate gardening "pen pals," swap seeds, trade videos, or share experimental data. Although the following classroom gardening descriptions are based on the 1989/90 school year, they will give you an idea of each teacher's classroom gardening focus. These teachers want to hear from you. We hope you'll make some contacts, and use the enclosed survey form to let us know if you'd like to be included in a future listing.

Lenora Smvot (4th grade)
Horizon Elementary
2101 N. Pine Island Rd.
Sunrise, FL 33304

This class raised NASA's tomatoes from space and red maple tree seedlings.

Noreen Breslauer (3rd grade)
c/o Sweethaven Farm
Weatogue Rd.
Salisbury, CT 06068

They've propagated plants from cuttings and learned percentages while germinating seeds.

Jan Peters (2nd grade)
Highland Elementary
2605 Longwood Drive
Reedsport, OR 97467

They've grown an indoor salad garden.

Scott Artley (jr./sr. high school special ed.)
Baraga Area Schools
210 Lyons St.
Baraga, MI 49908

Their GrowLab success led to their raising funds to build a greenhouse on the school grounds. They raise flowers for the school and to sell to the community.

Wendy Maynard (5th grade)
Woodrow Wilson School
43 Miriam St.
Daly City, CA 94014

This class raises salad gardens and tree seedlings from kitchen garbage, and conducts seed experiments. They'd like to exchange garden videos with other classes.

Green Tips

Presenting Peanuts

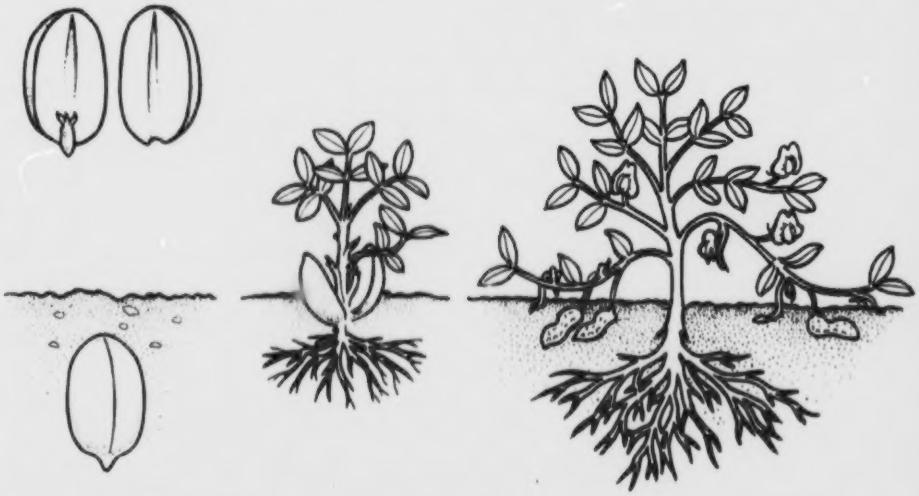
So, you've raised an herb or salad garden--experienced the excitement of growing lettuce, tomatoes, and cucumbers to maturity right in your classroom. What's next? Have you considered peanuts? Although they have a fairly long growing season--approximately 5 months--a few humble peanut plants indoors can provide a backdrop for studying history, geography, nutrition and more.

Planting and Care

You can order peanuts from a mail order seed company (see page 303 in *GrowLab: Activities for Growing Minds)* or purchase raw unroasted peanuts from a grocery or health food store. Try to get them in the shell, so students can examine these pods in their original form. For fastest germination, remove the individual peanuts (actually, the seeds) from the shells and soak them overnight before planting.

Be sure to save some soaked peanuts for close observation with a magnifying glass. As with beans, when the seed is split, students can see the young plant or embryo surrounded by it's food source, the cotyledon. Your class may choose to experiment by soaking some and not others, and planting some that have been left in the shell.

Like other seeds, peanuts are very nutritious. They have more protein than eggs, dairy products, and many types of meat. They're full of vitamins and minerals too. Challenge your class to discover why seeds of plants are so nutritious. If they've discovered the young plant inside the peanut, they might have a good guess. (These stored nutrients enable the young plant to live until its roots develop and its green leaves can make their own food.)



Peanuts prefer light, well-drained soil. The type of potting mix recommended for indoor classroom gardens will be fine for peanuts. You can save space by starting them in small containers, but will need to transplant each plant to at least a six- to eight-inch pot to grow to maturity. Peanuts will germinate most quickly if they're planted with the pointed end (where the embryo is) facing down. Of course, your students may already have discovered that roots will grow down and stems will grow up regardless of seed orientation. Perhaps they can experiment to determine whether the orientation affects how fast they germinate. Plant the peanuts 1/2"-1" below the soil. Like other seeds, they should be kept warm and moist during this time.

Your peanut plants should grow to about 18" tall. Once the plant has used up the stored food, the green cotyledons will shrivel up and fall off. You might want to remove one or both cotyledons from a plant or two to explore their importance to the plant. After about 6 weeks, bright, saffron-colored, pea-like flowers will develop. The peanut flowers are self-pollinated. The lower flowers on the plant, or the "pegs," lose their petals, and these ovaries grow downward on a vine toward the ground. As the peg approaches the soil, you can help it work its way down by adding some soil around it. Under the soil, these pegs mature into peanuts. With plenty of light and warmth in your indoor garden, you should have a few peanuts per plant develop underground in four to five months.

They're Nutritious!

- ***A doctor originally developed peanut butter for the elderly and invalids because it was so nutritious and easy to digest.***
- ***Peanuts contain 26% protein—more than eggs, dairy and much meat and fish.***
- ***Peanuts contain many B vitamins, polyunsaturated fats, calcium, phosphorus, potassium, iron, magnesium and no cholesterol.***

Peanuts Across the Curriculum

Science
Any activity that focuses on germination, plant growth, phototropism, plant needs, etc. can be adapted and used with peanuts. Try Magic Beans and Giant Plants from *GrowLab: Activities for Growing Minds.*

Nutrition
Find out what nutrients peanuts contain; compare their nutrient value to other foods; make peanut butter and peanut snacks; and develop your own recipes.

Language Arts
Discover the origin of the name "goober peas" for peanuts; develop a peanut book to share with other classes; record daily observations of your peanut plants.

History/Geography
Research where peanuts were first grown; discover where they travelled to throughout history; learn about the different uses people had for peanuts; find out how peanuts are grown today; learn about the life and accomplishments of George Washington Carver.

Other Areas
Produce and do a play for other classes about the history and life of peanuts; make your own cat litter using peanut shells and baking soda; make collages of products made from peanuts; challenge your students to invent new peanut products.

Math
Calculate germination percentages; predict future height of plants based on growth graph; calculate the amount of protein in a peanut butter sandwich; find a recipe containing peanut butter and multiply it to make enough for the class.

Peanuts: World Travellers

- ***There is evidence that peanuts were grown in South America more than 3000 years ago***
- ***The Spanish probably took peanuts from Mexico back to Spain; from there traders and explorers took them to Africa and Asia. When Africans were brought as slaves to North America, they brought peanuts for food, and planted them in the South.***
- ***In the 1700's, peanuts were mainly regarded as good food for pigs, and later for the poor; during the Civil War, peanuts gained popularity with soldiers.***
- ***At the turn of century, better equipment for planting, cultivating, and harvesting peanuts was developed. George Washington Carver, a botanist, researched peanuts as an alternative to cotton crops which were hurt by pests. He developed over 300 uses for peanuts.***
- ***Peanuts are versatile plants; they've been used in ink, lipstick, cooking oil, paint, soap, paper, shaving cream, pet litter, and wallboard. Many of these products contain oil extracted by pressing peanuts.***

Peanut Resource Books:

Presenting the Peanut ***(gr. k-2) and*** **Having Fun With Peanuts** ***(gr. 3-5). The Georgia Peanut Commission, 110 E. 4th St., PO Box 967, Tifton, GA 31793. These two activity packets are available free to teachers. Send a request to the above address.***

Peanut. ***Millicent Selsam. New York, Morrow, 1969.***

Science Fun with Peanuts and Popcorn. ***Rose Wyler. New York, Julian Messner, 1986.***

Elizabeth D. Newland (2nd grade)
Mountain Way Elementary
767 N. Granite Ave.
Granite Falls, WA 98252

They've measured and graphed their plants, made pizza sauce from herbs, grown a salad garden, and raised Mother's Day flowers.

Mike Eversoll (5th grade)
Indian Mound Middle School
6330 Exchange St.
McFarland, WI 53558

They've simulated acid rain on bean plants. They'd like to share acid rain information via a computer network.

Diane Albright (kindergarten)
Thomas Marks Elementary
430 Young St.
Wilson, NY 14172

They would like to exchange pictures of classroom gardens.

Sharon L. Marsee (K-5th grade)
St. Agnes School
400 Fontaine St.
Alexandria, VA 22302

These students have indoor and outdoor gardens. They would like to trade local seeds.

Scottie Sheehan (kindergarten)
Manzano Day School
4118 Sunningdale, NE
Albuquerque, NM 87110

These students have grown local seeds, Mother's Day flowers and other flowers as "friendship plants."

The following teachers expressed a particular interest in exchanging seeds with other classrooms:

A. Hill (5th grade)
Hamilton Elementary
Webster St. and 7th Ave.
Schenectady, NY 12303

Arthur Winakur (high school special ed.)
3787 Bedford Ave.
Brooklyn, NY 11229

Linda Woodall (1st-5th grade)
Village Community School
272 W. 10th St.
NY, NY 10001

Howard Schor (6th-8th grade)
PS 75
735 West End Ave.
NY, NY 10025

They have second generation space seeds to share.

Carol Hansen (4th grade)
Franklin School
1111 E. Mason
Santa Barbara, CA 93103

They've raised oak tree seedlings from acorns.

Resources

Book Reviews

The Beetle Bush. **Beverly Keller. Illustrated by Marc Simont. NY, Coward, McCann and Geoghegan, 1976. Grade 2 up.**

Arabelle Mott, although not yet waist-high to an adult, considers herself a failure. Since she is still pretty young, her parents persuade her to try another project. She tries growing a garden, and up come some veggies, but also weeds, snails, bugs, and moles. It makes for a lively garden, but very little harvest. Arabelle is determined to turn bad fortune into good and with pride shows off her flourishing weeds and her bush covered with beetles, and even finds a watermelon in the process.

The format and style are easy to read, with short sentences in large type interspersed with expressive sketches on every page or two. This quiet text presents a different view of gardening "success."

Reviewed by Sharon Levin, a school librarian in Burlington, Vermont.

* * *

Growing Vegetable Soup, **Lois Ehlert. NY, Harcourt, Brace, Jovanovich, NY. Preschool-grade 2.**

Color, color, glorious color abounds in Lois Ehlert's *Growing Vegetable Soup.* Simple shapes of gardening tools and plants in dynamic colors are set off by equally brilliant contrasting color backgrounds. The simple text takes the reader through the steps involved in planting, nurturing and harvesting a vegetable garden. This family's gardening project culminates in the creation of a pot of vegetable soup and the promise of more vegetables to grow in next year's garden. The inside of the book's jacket contains a simple recipe for making vegetable soup just waiting to be tried out.

This book complements nicely the whole language approach to reading instruction. The items shown on each page are clearly labeled--"bushel basket" or "zucchini squash" for example. This type of labeling helps the developing reader associate words with the objects they name. Although the book is designed for the preschool through grade two crowd, it would be appropriate for older elementary students who need exposure to the steps necessary in successful gardening. This book would be a wonderful companion to Marcia Brown's classic, *Stone Soup* for those interested in turning their classroom harvest into a meal.

Reviewed by Diane Elliott-Weaver, a 5th grade teacher in Champaign, Illinois.

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Activities for Growing Minds

When Mike Eversoll's students in McFarland, Wisconsin, were studying acid rain during a 6-week environmental unit, they wondered how they could find out what effect water of different pH levels might have on plants.

Mike used an activity called **"PlantAcid"** from our new K-8 curriculum guide, *GrowLab: Activities for Growing Minds*. PlantAcid helps students understand the concept of pH by measuring common substances. They then consider how living things are sensitive to changes in their environment, and work cooperatively to test the effects of pH changes on bean plants.

"It had a real impact on my students," said Mike, "The varied pH levels clearly had different effects on plants." The "Making Connections" section of the activity encouraged students to make inferences about the natural world, based on their investigations. A "Futures Wheel" worksheet helped them chart possible long term, multiple impacts of such an environmental change. An exercise called "taking a stand" had them examine some feelings on the problem of acid rain. Said Mike, "This investigation was a great motivator. It spurred my class to further investigate problems from acid rain and other pollutants."

Fifth grade teacher Beth Garver, on the other hand, wanted basic activities that her fifth graders could use to help first graders learn about seeds and germination. They chose the activity, **"Yo Seeds, Wake Up"** from *GrowLab: Activities for Growing Minds*. The fifth graders helped the younger children examine seeds and brainstorm ideas about what they might need to grow. A short story about seed needs set the tone for the younger students to experiment with some of their own ideas. The activity gave the student instructors a structure and an idea of what outcomes to expect, but encouraged them to follow up on student suggestions.

Mike and Beth adapted activities from *GrowLab: Activities for Growing Minds* to fit their unique classroom situations. We hope you're doing the same. If you are using the book as a resource, use the enclosed survey to fill us in on your experiences. What worked? What didn't? What extension activities can you add to our list? What new activities would you like to see developed?

To order *GrowLab: Activities for Growing Minds*, send $19.95 plus $3.00 for shipping and handling to: National Gardening Association, Dept. GI, 180

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Burlington, Vermont 05401

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To continue receiving your free issue of Growing Ideas, please include your name and address on the enclosed survey form.

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A JOURNAL OF GARDEN-BASED LEARNING

Growing Ideas

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Classroom to Classroom Exchanges

So many of you have expressed interest in exchanging everything from native seeds to videos to experimental data with other classes, that we're printing our classroom exchange list separately from the newsletter. The list gives teachers' names, grades, addresses, and a short blurb about classes wishing to exchange materials and information with other gardening classrooms. For a copy of the list, send a stamped, self-addressed envelope to: **Classroom Exchange, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.**

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Lunar Harvest

While some scientists are busy trying to improve methods for raising food crops on Earth, others have turned their thoughts skyward. Some Milwaukee members of the National Space Society have set up a nonprofit corporation, LUNAX (Lunar National Agricultural Experiment Corporation), to promote lunar agriculture experiments in schools. Their efforts sprung from their belief that human colonies on the Moon will only be possible if they are nearly self-sufficient in growing their food. "What's so compelling to us and to students," says LUNAX board member, Peter Kokh, "is that these are true experiments for which no one yet has answers."

Although they have worked primarily with high school and college science classes, LUNAX members are intrigued by the idea of engaging younger indoor gardening students in lunar investigations. The LUNAX experiment they suggest for classrooms with light gardens is the **"Lunar Nightspan Hardiness Experiment."** Because the moon has a 14 Earthday span of daylight and a 14 Earthday span of darkness, plants would have to be artificially lighted during the two-week lunar night. Since providing this light will require much expensive power, researchers want to determine how little light different types of crops can get by on during the two-week dark cycle.

Peter suggests trying to grow different types of plants under a simulated lunar cycle, experimenting to see how little additional light during the 2-week lunar night will still produce reasonable harvests. He suggests germinating seeds during the middle of a simulated 2-week lunar dark period. Once seeds germinate, use just a few hours a day of lighting. After a week, if plants are still alive, give them two weeks of 24 hours per day of light to simulate the 2-week lunar day. Then go for 2 weeks with students' own light-rationing pattern that might be used during a lunar night. For example: 4, 6, or 8 hours of light a day or 12 or 18 hours of light every second or third day. A sample schedule follows:

Day 1-7: No lights; then 2 hours per day once germinated.
Day 8-21: 24 hours of light per day
Day 22-35: 6 hours per day
Day 36-51: 24 hours per day
Day 52-65: 6 hours of light per day

Consider putting an opaque covering over the light garden to keep out classroom or outside light during simulated lunar dark periods. It can be painted white on the inside to reflect light onto plants during light periods.

LUNAX is interested in all results and experiment conditions. "Students should realize," says Peter, "that what might be considered 'failures,' such as plants dying from insufficient light, are actually successes, since all information is vital to our understanding of conditions necessary for lunar plant growth." When

(continued on page 11)

Classroom Exchange

Marigolds, Seed to Seed

- When Sudbury, Massachusetts preschool teacher Wendy Sherman brought full grown marigolds from her garden into class last fall, she challenged her students to predict if and where they'd find seeds. They examined, then removed the flower heads and let them dry on a screen for a month. At that point, groups of students closely examined the still colorful flowers. This time, they discovered what seemed to be hundreds of seeds. "Some students had been doubtful, and were pleased to see that our collected seeds were indeed the same as those I later brought in seed packets," said Wendy. After April vacation, they sowed the seeds, which grew into hearty plants for Mother's Day. Students made clay pots in which to set their paper cup seedlings. "The mothers appreciate this project," says Wendy, "because it's something realistic—and many like to continue the project. I send a note home telling mothers how to collect seeds from their flowers to start another cycle with the kids."

Focus on Herbs

- A belated congratulations goes to Hartford, Connecticut junior high teachers Brenda Kurns (science) and Rosemarie Deming (home economics) for their Department of Education "Celebration of Excellence" award for a "From Soil to Table" indoor herb project. Brenda's science class grew and explored the anatomy of a wide range of herbs, while the same students in Rosemarie's home economics class researched and prepared herb-dominated recipes from other countries. Cooperative groups took responsibility for growing, researching and caring for herbs including basil, tarragon, oregano, sage and thyme. When they reached maturity, each group was responsible for planning, preparing and presenting such culinary delights as chicken tarragon or pasta with basil pesto. "The international buffet," said Brenda, "enabled students to use their five senses to explore how herbs can change the entire character of foods. The project offered an exciting opportunity to discover that science and consumer home economics are interrelated."

Thyme
ABC SEED CO.
Marigolds
GREEN THUMB CO.

- Meanwhile, in the state of Washington, seventh and eighth grade students in Patti Dore's class cooked up an Italian bread called Focaccia and savory spaghetti sauce from herbs raised in the classroom. Rather than start them from seed, Patti potted up parts of her basil, oregano, rosemary and jalapeno plants for the classroom. "The students got very inquisitive," said Patti, "I frequently saw them looking at the plants, rubbing the leaves and evaluating the aromas. I realized then that it was an entirely new idea for my students." Patti tries to incorporate into recipes fresh foods raised in the classroom whenever possible. She even claims that her students prefer cooking with fresh vegetables and herbs to baking sweets!

The Secret Garden

When students in more than 100 of Nashville, Tennessee's fourth grade classrooms read the children's classic *The Secret Garden*, this year, it came alive. It was one part of an exciting, interdisciplinary half-year school gardening project developed by the Cheekwood Botanical Gardens. They kicked off their ambitious "Secret Garden" project by donating copies of Frances Hodgson Burnett's book to area classrooms. While teachers read the book aloud to their classes, the botanical garden sent trained volunteers into the classrooms to help students plant mystery seeds and bulbs. During the following weeks, students worked in groups to observe emerging plants and keep careful journals.

Accompanying teachers' materials suggested how *The Secret Garden* could be used to meet curriculum requirements in a range of subject areas. In language arts, for example, students identified language diversities (colloquialisms, slang, etc.) in the book. Meanwhile, Cheekwood staff worked with annual Antique and Garden show staff to create a life-size, walk-through replica of the secret garden, complete with a ten foot high soft-sculpture tree. A "discovery room" (waiting area) engaged the students with a plant identification wall, practice bulb-planting station, seed-sort challenge, and a design-your-own- garden felt board. Local business donations enabled more than 1,800 students to visit the exhibit.

Growing Ideas is published three times a year by the Education Programs Department of the National Gardening Association. *Growing Ideas* provides instructional ideas, horticultural information and a forum for exchange among teachers using classroom gardening to stimulate learning. For a complimentary issue of *Growing Ideas*, write to: *Growing Ideas*, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.

Editor: Eve Pranis
Contributors: Diane Elliott-Weaver, Debbie Sovereign

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National Science Foundation
Opinions expressed are those of the authors and not necessarily those of the Foundation

They Prefer Being Green

- High school students in Plymouth, Michigan, are learning that they have the ability to improve their physical environment. Science teacher Sally Deroo and some students in her environment class proposed to remove window panels and turn a bleak common entry area into a hallway of greenery. "You're crazy," they were told. "With 5,000 kids in the school, a setup like that would be vandalized and destroyed in no time." On the contrary, the entryway has become a welcoming centerpiece with everything from hanging houseplants to potatoes in 5-gallon buckets, and has helped to set a stimulating tone for the school. "Not only has there been no vandalism," remarked Sally, "but students have taken a strong active interest in the plants. Occasionally one is removed, but ends up being carefully placed elsewhere to brighten up another part of the school. The student government became so enthused that they are planning a fundraiser to expand their school garden. It's really sparked interest in more environmental projects and even in helping younger students in nearby schools start gardens."

Harvesting Success

Most of us have been awed to see a small seed become a huge, food-bearing plant--we've experienced the satisfaction and success that with raising and nurturing living things. Plants elicit a particularly strong emotional response with students who face special challenges to learning. We hope that highlights from this special needs classroom will enrich your understanding of the potential of plants to touch your students on many levels.

Truants Tend Tomatoes

Lou Meyer teaches a self-contained classroom of fifth through eighth grade students in an Opportunity School Program at Sutter Middle School in Sacramento, California. Students are in his special program not because they are incapable of doing well in school, but because they have severe behavior problems. Most are on probation, have high truancy rates, and don't get along with others in regular classrooms. The goal of the school is to change students' behaviors and poor attitudes about themselves; teach them to take responsibility for their own actions; and to get them to catch up academically.

Lou recounts that his discovery of the power of plants was an accident. "I had some plants in the classroom. After a few kids asked to water them, I decided to allow each kid to grow his or her own tomato plant from seed. I told them they were completely responsible for caring for the plant and that I wouldn't feed, water, or otherwise care for their plants. I began to notice that kids who had been truant would sometimes come in after school to water their plants."

At the end of the year, when the class lined up all of the tomato plants, they ranged from tall, robust plants to sad, dead specimens. This launched a lively discussion about taking responsibility for other things and for our own actions, and recognition that both students and plants need food and care to grow.

Since then, Lou's students have become enthusiastic plant caretakers. Teachers have started bringing in sick plants which the students help remedy. To do so, they must read resource books to learn about the needs of different types of plants. Their new knowledge and enthusiasm has sparked an interest in raising houseplants and flowers to plant around school, for teachers' desks, and to sell in the school store. Their lunches are enriched by salads of lettuce, tomatoes, cucumbers, and radishes that they've grown themselves. They've even written a book on how to care for plants.

Lou adds, "I don't push the kids, but leave the door open and let them slip in. Once they feel successful in helping something grow, they'll be hooked. I also try to follow their lead and interests. When students wondered about growing plants in fertilized liquid without dirt, Lou responded, "Let's try it!" These tough, ordinarily recalcitrant kids became interested enough in plants to care, and Lou used that interest to bring them into the learning cycle.

His students have "incorporated" their school plant business, allowing participants to purchase "Our Green Creations" stock for 25 cents a share. The school store gets a commission on sales, and if profits are made beyond that, stockholders can increase their investment. To ensure a steady supply of plants and success of the sales programs, students have realized that they must come to school to participate. "After one month of sales," said Lou, "our stock is being traded for 50 cents a share on the open market!

"Our indoor gardening effort is congruent with our school's focus on responsibility, self-confidence and skill training" says Lou. "The kids are responsible for planning and following through with projects. They must learn to cooperate and follow directions and rules for things to grow well—they can readily see the consequencees of their actions—they've learned, in fact, that some things can be killed with kindness!" Lou attributes his high success rate for placing these kids back in a regular school program to their growing endeavors.

Green Tips

Move 'Em Out

In most parts of the country, it's nearing time to transplant some of the seedlings many of your students have carefully tended, to outdoor gardens or flower beds. Transplanting their precious plants can reinforce students' understanding of basic needs and offer valuable practice in caring for living things.

Before transplanting, help students understand that moving a plant from a warm, windless, relatively protected classroom environment to a harsher outdoor environment can create a state of shock. Consider conducting part 2 of the Exploration in "Why Root for Roots" in *GrowLab: Activities for Growing Minds* so students can observe what can happen to a plant that has had it's roothairs disturbed and broken. Pulling up a plant for transplanting inevitably injures the roots to some degree. Since the roots take in water and nutrients from the soil, the plant will have a hard time getting what it needs to survive until its roots heal.

Hardening Off

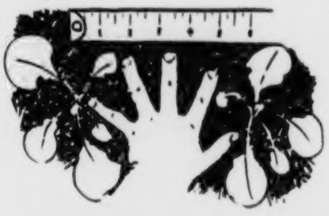
One important step to improve your transplants' chances for survival is to "harden off" seedlings before planting them outdoors. This means getting seedlings slowly accustomed to the tougher conditions they will face outdoors. (Challenge your students to think of human analogies!) A week or so before transplanting seedlings, set them outside for a short period (1 or 2 hours) during the daytime. Do this for longer periods each day. A couple of days before transplanting, leave them out all night as well. This "hardening off" period, during which leaves actually thicken up, will give plants a much better chance of surviving the shock of transplanting.

Transplanting

The best time to transplant seedlings outdoors is on a cloudy or even drizzly day. This will prevent the rapid water loss that transplants with damaged roots would suffer on a sunny day. The sturdiest, greenest, most compact plants are those most likely to be transplant survivors. (Consider discussing how healthy people, like healthy plants, are best able to withstand illness and other challenging conditions.)

To protect roots, ensure that as much soil as possible clings to them when they're removed from their containers. Water plants before transplanting to help the soil cling to the roots. When you decide where to plant your seedlings, water that soil as well.

Transplanting seedlings can help reinforce measurement skills. Gardening books, seed catalogs, and seed packages will tell you how far apart to place specific plants. Students can use rulers to determine space between rows and between plants, or can use a body part such as a hand span to measure distances.



Have students remove plants from containers very carefully. If seedlings are in flats with others, they should be gently pulled apart, keeping as much soil around the roots as possible. Remind students not to tug on or bend the seedlings' stems. (If they've learned about the function of stems, they should realize why this is important.)

What Goes Out Wh[illegible]

Cool weather cro[illegible] broccoli and cabbage, can b[illegible] out up to a month before th[illegible] danger of frost in your area. [illegible] preferring warmer wea[illegible] tomatoes, melons[illegible] peppers, should be transplanted out after all danger of frost is past for your area. Root crops su[illegible] carrots and beets, and legumes such as peas and beans, do [illegible] transplant well. Crops such as cucumbers, melons, and corn [illegible] tender root systems, but can be transplanted from individual containers if done so with little root disturbance. Have students check seed packages, catalogs, or gardening books for information on specific herbs and flowers.

For each transplant, dig a hole (with either hands or trowels) a bit larger than the rootball of your seedlings. If you have compost or rotted manure for your transplants, dig the hole even larger and mix some of that into the hole before planting.

Place the plant in the hole and fill it up with soil, holding the plant so that it is about the same depth as it was in the container. Tomato seedlings are a notable exception. They will form small roots on buried portions of stems, and will thrive when buried up to their first set of leaves. Press the soil gently to fill in around the roots, leaving a small

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depression near the stem to hold water. Water seedlings well after transplanting. Seedlings may benefit from a watering of a very dilute manure tea, seaweed or other fertilizer, although too strong a solution can harm fragile roots.

Often after transplanting, seedlings look droopy or wilted since the damaged roots have limited ability to take in water. If it's very windy, you can place materials such as cardboard, paper bags, or cheesecloth around seedlings for protection. As the days go by and the roots heal, your students should notice their transplants looking healthier and perkier.

Assessing Growing Minds

We've learned, from years of gardening with kids, that hands-on plant explorations provide fertile ground for first-hand learning of important life science concepts. Watching a seedling unfurl, experiencing the response of a neglected plant, or trying to influence the direction a root grows—concepts come alive. As students observe their plants, gather data, make predictions about plant growth, and design experiments to test their own questions, they practice and sharpen important science process and problem-solving skills. And as they work with living things and come to understand their needs and interdependencies, students' attitudes toward their environment continually broaden.

As educators, we're often asked to document student gains to parents and administrators, or to convince funders of the value of garden-based curricula. With the national push for improvements in science performance, it seems inevitable that teachers will be under increasing pressures to assess student gains and defend their programs. Fortunately, at the same time, there is increasing recognition that "gains" must be measured using a broad range of strategies.

In a preliminary GrowLab survey conducted with more than 200 teachers in 1990, we were pleased to learn that students in GrowLab classrooms show significant positive gains in a number of areas including: observation skills, respect for living things, awareness of human impact on the environment, and understanding basic needs of living things.

We are currently testing students in 95 gardening and nongardening classrooms nationally to learn more about the effectiveness of GrowLab science instruction. Because of the large number of students we're testing, we developed paper and pencil-type measurements. But we don't believe that these types of measurements alone reflect what kids understand, believe, or are capable of doing. The standard multiple choice format, for instance, precludes students' unique interpretations, gives no insight about students' reasoning, and doesn't assess skill performance.

We will share results from our national assessment in the September issue of *Growing Ideas*. Meanwhile, we're eager to hear what your students have gained from their growing experiences, and how you measure their progress. How do you formally assess gains in your students' understanding of plant adaptations, observations skills, or ability to set up a fair test? As classroom teachers, you can also informally monitor your students' progress. Consider what you gain from examining journals, observation records, and drawings; watching students care for plants or set up experiments; observing student discussions. Are students asking more open-ended questions? Are they able to design experiments to answer their questions? Do they apply what they've learned with plants in the classroom to other contexts? Have you noticed behavioral changes that might indicate shifts in attitudes? For instance, do students show increased interest in caring for plants? Are their cooperative skills improving?

You will find a few suggestions for assessing your students' learning on pages 14 and 15 of *GrowLab: Activities for Growing Minds*. You have probably also developed your own methods. Please use the survey form on pages 9 and 10 of this newsletter to let us know techniques that have worked well for you. And please share some of your results, whether anecdotal or formal.

In 1991/92, we will take an in-depth look at several GrowLab classrooms, to examine other results of garden-based inquiry science. We'll also look at how teachers have incorporated the inquiry-based lessons from GrowLab: Activities for Growing Minds into their curricula. This will include in-depth classroom observations, interviews, and parent surveys. If you are interested in participating in this phase of our evaluation, write to: Eve Pranis, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.

What...No Soil?

Classroom Hydroponics

Imagine growing food in outer space, feasting on fresh, leafy lettuce during cold winter months, or getting 1,000 pounds of tomatoes from one plant. These are some of the visions that have drawn horticulturists and other scientists to research and practice *hydroponics*—or growing plants without soil.

A number of you expressed interest in exploring hydroponics in your indoor classroom gardens. So we spoke with horticulturists, educators and hydroponic equipment suppliers to find out about hydroponic setups that would be relatively easy and inexpensive to implement in classrooms. While some controversy exists about the role of hydroponics agriculturally (see "Branching Out"), raising plants without soil allows students to consider basic plant needs and view root growth, and provides a good context for devising experiments to test their questions. (The controversy also provides fertile ground for research and debate!)

Background - Meeting Plants' Needs Hydroponically

The word hydroponics actually comes from two Greek words—*hydro*, meaning water and *ponos*, meaning work. With hydroponics, a solution of water and nutrients surrounds the plant roots, doing the work of soil. Hydroponic devotees believe that a more efficient system results from feeding plants directly, rather than feeding soil to feed plants. It allows the plant, they say, to put energy into leaves and fruits rather than into growing more roots to search for water and nutrients. Plants grown hydroponically still have the same needs as those grown in soil. A discussion of how these needs can be met follows.

Nutrients. Soil contains mineral nutrients necessary to plants' survival. Plants in hydroponic systems need a fertilizer solution that provides all of the primary plant nutrients (nitrogen, potassium, phosphorus) as well as important trace elements such as iron, manganese, and sulfur. (See pages 48-50 of *GrowLab: Activities for Growing Minds*, for nutrient information.) Many garden or houseplant fertilizers lack the trace elements necessary to grow crops without soil. If you find one that includes minor elements, try using it. Otherwise, look in science supply catalogs or write to the business listed in the sidebar for nutrients for hydroponic growing.

pH. Most of the plants you'll raise in the classroom garden grow best between the pH range 6.0-6.8. Because tap water differs in pH across the country, you'll have better results if you test and adjust the pH of your tapwater planting. If you have narrow range pH paper, available at aquarium supply departments, or an electronic pH meter, test the pH of your tapwater and adjust it to pH 6.0-6.8. You can use white vinegar or lemon juice to lower the pH, and baking soda to raise it. Start by adding a small amount, testing pH, and increasing until you've reached the appropriate range.

Although soil pH changes slowly over time, evaporation and transpiration will continually change the pH of a hydroponic solution and result in too concentrated a nutrient mixture. Whichever setup you're using, replace the solution every week or two, adding fresh nutrients and adjusting the pH each time.

Stability and oxygen. Most hydroponic setups have some material to support the plants. Sand, vermiculite, pebbles and a spongy, fibrous material called rockwool (see page 7 for sources) are typically used. Since roots require some oxygen, aquarium-type pumps are often used for small-scale setups. However, the fibrous material, rockwool, allows some air penetration, and may be used successfully in a setup without a pump. For short-term school projects, a setup such as that illustrated in figure C of the Exploration, with no aeration, may be adequate.

Laying the Groundwork

- Consider laying the groundwork for a hydroponic project by having students brainstorm a list of the purposes soil serves for plants. This will probably include such factors as providing support or stability, and carrying water, nutrients and oxygen to plant roots.

- Have students brainstorm another list of ways in which plants grown without soil could have the same needs met.

- In addition to referring to the soil background and activities on pp. 101-115

Free Hydroponic Materials

Suncor Systems in Portland, Oregon will send a free small hydroponic system (including a nutrient reservoic, nutrient solution, rockwool/styrofoam support, basil seeds, and instructions) to interested classroom teachers. Send requests to: Chuck Erickson, Suncor Systems, Inc., P.O. Box 11116, Portland, OR 97211.

of *GrowLab: Activities for Growing Minds,* consider using the "Laying the Groundwork" section from the "Earthgrippers" activity to stimulate thinking about the relationship between roots and soil.

- Encourage student suggestions for hydroponic setups, and have students discuss how each suggested design would meet plant needs. Share background information from this article as appropriate.

Exploration

- Have students set up their own designs, or choose one from the samples illustrated below. They are some of the simplest suggestions we found. If you develop variations, we'd love to hear about them!

- Consider experimenting with different types of designs. Don't let lack of equipment, such as an aquarium pump or pH meter, stop you. You're likely to see results from even a basic design. You might try, for instance, growing plants with and without adjusting the pH or with different types of growing media such as sand, vermiculite or rockwool. Students will likely want to compare hydroponically grown plants to those raised in soil mix.

- We suggest beginning with such crops as lettuce, herbs, and houseplant cuttings, and experimenting with other plants once you have a feel for the setup.

Making Connections—Discussion Questions

- How did your setup meet different plant needs? Were there some needs that were not well met? What did you observe to make you believe that?

- If you compared plants grown with and without soils, did you observe any differences? What were they? What do you think caused them?

- Where, in nature, have you seen plants growing without soil? Did they appear to have specific adaptations to grow in a soilless environment? What were they?

- Can you think of any purposes of soil that are not fulfilled by hydroponics?

- How do you think hydroponic growing could be used in world agriculture? What type of limitations do you think it has?

- Would you rather raise a garden hydroponically, or with soil? Why?

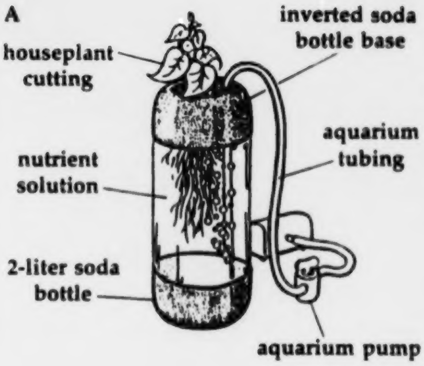
Branching Out

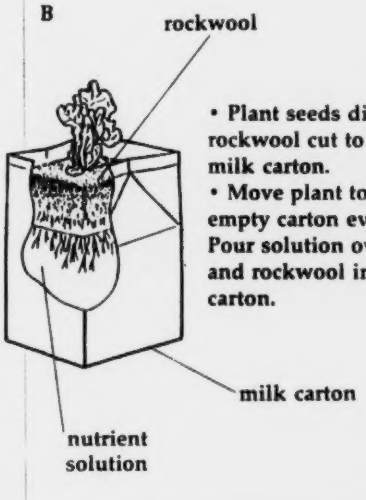
- Some people think that using hydroponics to grow food crops can reduce pest problems, result in less contaminated food, increase yields, be carefully controlled--and as such, can answer many of our agricultural problems.

Others feel that hydroponics requires high energy and labor inputs and monitoring, and that overemphasizing them might diminish our concern for the soil and and for ecologically benign agricultural practices. Your students may want to do further research on this controversy, and debate these questions in class.

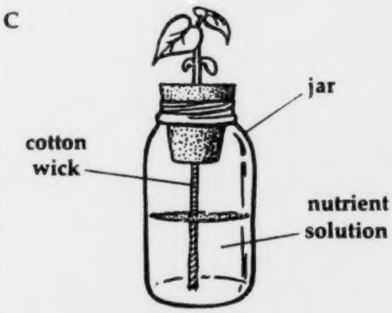
- Research aquatic plants and learn about the adaptations that help them lead soilless lives.

- Try growing and comparing plants grown in salt water and fresh water.





• Plant seeds directly in rockwool cut to fit in milk carton.
• Move plant to an empty carton every day. Pour solution over plant and rockwool into new carton.



• Write for hydroponic information and activity [illegible] to:

[illegible]

EPCOT Educational Media, 500 South Buena Vista, Burbank, CA 91521. Phone: 1-800-423-2555.

[illegible]

Hydroponic Society of America, Box 6065, Concord, CA 94524. Phone: 415-682-[illegible]

Natural Curiosity

Like your students, scientists are always asking questions. These questions often spark investigations to look for answers. Many of the scientists who have studied plants asked questions not so different from those of your students. Consider having students research how different plant scientists went about asking and answering their own questions. Some of the more well known plant scientists, and one of each of their questions, are listed below.

Jean Baptiste Helmont: "Does the weight a plant gains as it grows come from its eating the soil?"

Steven Hales: "How does water move through plants, and where does it go?"

Joseph Priestley: "Do plants breathe and 'damage' air like animals do?"

Carl Linnaeus: "Can plants be classified and given a simple, two-word name that will show how they're related to other plants?"

Charles Darwin: "How do plants move—both individual plants (tropisms) and seeds that will make new plants (seed dispersal)?"

Rachel Carson: "Are there ways of controlling pests that are less harmful to our environment than the chemicals we use now?"

John Burroughs: "What can we learn from simply observing trees, flowers, insects and birds?"

Luther Burbank: "Are all plants of a particular kind really exactly alike? If not, can I cross two that I like to get one that is even better?"

George Washington Carver: "How many different products can we make from peanuts and soybeans?"

Adapted from an article in the December 1990 issue of Cultivating Kids, published by Seattle P-Patch, a Cooperative Extension gardening program.

Growing Partnerships

Exciting partnerships continue to bloom between schools and community organizations and businesses committed to garden-based learning. Peter Larrow, a Montessori school teacher, and Dennis Weilnau, a Cooperative Extension agent in Sandusky, Ohio, put their heads together to figure out where they could find funds to build GrowLab Indoor Gardens for the school. Their local electric utility company, they discovered, had a mini-grants program to help teachers buy energy-related materials for the classroom. What could be more energy-related than a program involving plants, the ultimate food and fossil fuel energy producers?

With funding from a local Kiwanis club, the electric utility, and support from Cooperative Extension, fourth through sixth grade students and teachers learned about electricity and more as they built frames and wired lights for GrowLab units.

Once the GrowLabs were built, the Montessori wondered whether they could find other partners to help them make the GrowLabs blossom. As a group, they brainstormed the types of things they would like to explain to potential partners about their school and their gardening plans, and what kinds of help they would ask for. After developing a group form letter, each student wrote to a local or national garden-related business or organization.

"The response was tremendous," said Peter. "At least 90% of the letters were answered, which made the kids feel great." They received donations from seed companies, tree seedlings from a local nursery, and pledges of support from local garden clubs, to name a few.

When nursery owner Sharon Barnes received a student's letter asking for a donation of potting mix, she responded with an exciting offer. Her nursery is beginning to develop a yardwaste composting program, using lawn clippings, leaves, woodchips and other yard waste from local homes and municipalities. Since she'd rather have these materials composted and reused than buried in landfills, Sharon has offered the fourth through sixth graders the opportunity to test the effects of different types of compost in their GrowLabs. She hopes to spark students' interest in the concept of composting, and engage them in classroom experiments that have "real life" applications.

Peter Larrow suspects they'll take Sharon up on her offer, and expressed his delight with the follow through on offers of support. "Local garden club members continue to stop by to see what's up and offer a hand," says Peter. "A local grower called to say that although he doesn't currently have seeds to send, he'll be sure to send some over in January." Students' communication skills are sure to flourish as they respond with thank-you's, and keep new partners up-to-date on their classroom gardening projects.

We'd like to hear more about your growing partnerships. In each issue, we'll highlight one community/school partnership. Your success stories can help other teachers and can help us develop materials so partners can better meet teachers' needs. If you work with community partners, let them know of our special resource, GrowLab Partners' Guide: Building Community/School Partnerships Through Indoor Gardening.

☑ Survey

Share Your Growing Ideas

Sharing your classroom gardening experiences can help make this newsletter a useful resource for teachers nation-wide. Please take a few minutes to complete this survey, let us know whether you'd like to continue receiving free issues of *Growing Ideas*, and return this form to: **Editor, *Growing Ideas*, National Gardening Association, [illegible] Flynn Avenue, Burlington, VT 05401.**

Name ______________________ **School** ____________________________ **Grade** ______

Street ____

City ______________________ **State** ______ **Zip** ______ **Phone** ______________

☐ Please continue my free subscription to *Growing Ideas*.
☐ Please send more information on the GrowLab Program.
☐ Please send information on the video, "A Growing Experience."
☐ Please send information on the fall training workshop nearest to me.

*** Briefly describe some of the activities and projects that have been highlights of your GrowLab experience. (For upcoming issues, we're particularly interested in tree projects, habitat and biosphere simulations, and your own designs for homemade light gardens.)**

*** If you have used activities from *GrowLab: Activities for Growing Minds*, please let us know what you thought of them. What worked? What didn't? How would you suggest adapting activities?**

*** What are some ways in which you assess what students have gained from their growing experiences? Please describe some significant gains. (Consider content understanding, skill use, attitude and behavior changes.)**

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*** List your favorite fiction or nonfiction books that support your indoor gardening efforts. (Place a check next to those for which you'd be willing to write a brief review for *Growing Ideas.*)**

*** Describe ways in which your classroom gardening efforts have benefitted from outside support or "partners" (e.g., volunteers, material donations, funding).**

*** Describe what, if anything, your class would like to exchange with other GrowLab classrooms (e.g., pen pals, specific experimental data, seeds from local plants, special seeds, videos).**

*** List any gardening, plant-related, classroom management and other questions or problems you'd like addressed in this newsletter.**

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Place stamp here

Editor, Growing Ideas
National Gardening Association
180 Flynn Avenue
Burlington, VT 05401

Resources

More Than Just a Vegetable Garden. Dwight Kuhn. Silver Burdett, 1990. Grade 2 up.

Lush color photography leads you through places you've never been before. Miniscule, hidden habitats house creatures that help and hinder your garden's growth. Your students will learn how earthworms help their garden grow by aereating the soil, and how ladybugs and mantids eat insects that are harmful to your garden. Cut-away photographs of various tubers including radishes, carrots and potatoes show what life is like for plants underground. In a wonderful, very visual way, this book confirms that there is more to life in a vegetable garden than seeds and fruit! A plan for starting your own garden, a glossary, and an index are included.

Reviewed by Diane Elliott-Weaver, a 5th grade teacher in Champaign, IL.

***Top Secret.* John R. Gardiner. Little Brown Pub., 1985. Grade 4 up.**

Allen Brewster didn't know what he was getting himself into when he decided to do his science project on human photosynthesis! This is a wacky tale about a nine-year-old boy who turns himself into a plant. Not only does Allen deal with the problems of turning green and sprouting roots, but the president's secret service men are also watching him.

This book can be used for several whole language activities. The story lends itself well to teaching cause and effect (e.g., *If people don't need to eat, then* _______.) Students could also be encouraged to contemplate the advantages and disadvantages of being a plant.

This book will help you turn your students on to science and the wonders of plants, and will motivate their creative minds.

Reviewed by Debbie Sovereign, a 4th grade teacher in Nespelem, WA.

(*Lunar Harvest* continued from page 1)

recording information, include the seed types used, planting dates, average room temperature, humidity in GrowLab, plant height, plant color, and any other observations that are of interest.

Mail your results to: LUNAX, PO Box 275, Green Bay, WI 54305. (We would also appreciate a copy of your findings so we can highlight them in this newsletter!) Enjoy your mission!

ORDER FORM FOR GROWLAB COMPANION GUIDES

(*Growing Ideas* Newsletter is free with your order.)

GrowLab: A Complete Guide to Gardening in the Classroom - This 128-page guide has instructions for raising vegetables, flowers and herbs indoors. It includes sample projects, an annotated resource section, and complete plans for a build-it-yourself wooden GrowLab.

GrowLab: Activities for Growing Minds - The National Science Foundation funded the development of our 307-page, K-8 curriculum guide. Written by educators and classroom-tested, the guide includes creative activities for hands-on, inquiry-based science lessons, reproducible students journal/recordkeeping worksheets, and suggestions for extending lessons throughout the curriculum.

PLEASE SEND ME THE FOLLOWING:

__ copy(ies) of *GrowLab: A Complete Guide to Gardening in the Classroom* at $14.95

__ copy(ies) of *GrowLab: Activities for Growing Minds* at $19.95.

☐ information on purchasing GrowLab Indoor Gardens and supplies.

$_____ Total Amount of Order (Add $3 for postage and handling if under $30. If over $30, add 16% of the subtotal.)

☐ Check or money order enclosed. ☐ Charge to: ☐ MasterCard ☐ Visa

Card Number __________ Expiration Date ____ Signature __________

☐ Bill school or organization: Purchase Order Number __________

If the books are to be billed to a different address than they're shipped to*, put billing address here:

BILL TO: Name __________ School/Org. __________ Phone __________

Street __________ City __________ State ____ Zip __________

*** The books will be shipped to address on the label on the other side, unless otherwise noted. Please write label changes legibly!**

Thematic Seed Collections

Kathy Wildman, a gardener in Sunbury, Ohio, strongly believes that hands-on experiences with plants and gardens help students learn important lessons about the environment. In an effort to help teachers using plants in the classroom, Kathy solicited donations of thousands of last year's seed packets from Robinson Seed Company in Columbus, Ohio. She then sorted the seed packets into thematic collections which she is offering to teachers nationwide for a minimal fee.

Each collection, appropriate for indoor and/or outdoor gardens, contains between 10 and 20 seed types. If a collection has fewer than 20 types, Kathy will add packets for a total of 20. The thematic sets are:

- Herbs and Edible Flowers. Includes savory, parsley, oregano, dill, nasturtiums, basil, and more.
- All in the Family X 3. To supplement studies of plant families, this set includes seeds from the cabbage, tomato, and melon families.
- Lettuce Be Different. Contains seeds of nine lettuce varieties for use with "Lettuce Be Different" from *GrowLab:Activities for Growing Minds.*
- Salad Bar. Contains all you might want in a salad including lettuce, peas, chives, nasturtium, tomatoes, beans, sunflowers, and carrots.
- Vegetable Garden. A potpourri of 20 vegetables.
- Flower Garden. A set of 20 flowers.
- Spaghetti Dinner. Includes tomato, eggplant, zucchini, green pepper marjoram, oregano, onion, thyme, basil.
- Fragrance Garden. Includes balsam, alyssum, dianthus, lavender, stocks.
- Indian Farming. This set, appropriate for an outdoor garden, contains two types of corn, pole beans, pole peas, winter squash, pumpkins, sunflowers.
- Dried Flowers. Includes celosia, strawflowers, statice, baby's breath, poppies, zinnias, and more.
- Fall Decorations. Contains ornamental pepper, gourds, mini-pumpkins, indian corn, black-eyed susans, strawflowers, and more.
- Southern Cooking. Why not plant some of these seeds, to tie in with a history unit on the South? Includes cow peas, collards, turnips, rutabagas, mustard, watermelon, okra.

To Order Seed Collections...
Send a letter detailing the packets you want (including a first, second, and third choice for each one ordered) and a check or money order for $5.00 for each collection (20 packets) to: **Kathy Wildman, 3977 Condit Road, Sunbury, OH 43074. Phone: (614) 965-2133.**

Growing Ideas

National Gardening Association
180 Flynn Avenue
Burlington, Vermont 05401
(802) 863-1308

ATTENTION

- *We recently received funding to conduct fall, 1991 regional training workshops in the Seattle, Philadelphia, Denver, and Chicago areas. Contact us for more information.*
- *There has been an unexpected manufacturer's price increase on GrowLab equipment. A limited number of units are available at the old price. Call or write for details.*
- *To continue receiving your free issue of Growing Ideas, please include your name and address on the enclosed survey form.*

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A JOURNAL OF GARDEN-BASED LEARNING

Growing Ideas

Published by the National Gardening Association **Volume 2, Number 3, September, 1991**

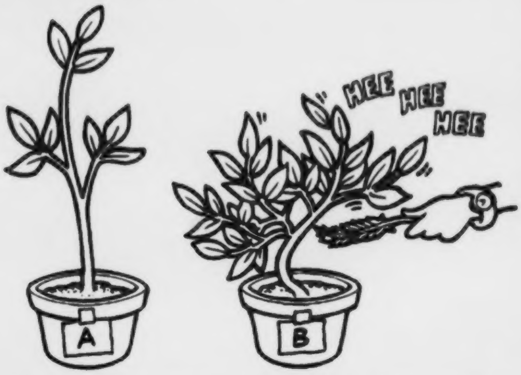
Classroom-to-Classroom Exchanges

Jan Peters's second graders in Oregon sent fir tree seeds from their area, along with photographs and letters, to a class in Ohio. The students were thrilled to receive in return native wildflower seeds to raise in their GrowLab℠, along with the Ohio students' photos and responses.

More than 80 classrooms, wanting to share everything from native seeds to videos to experimental data with other gardening classrooms, are described in our Growing Ideas Exchange list. The list gives teachers' names, grades, addresses, and a short blurb about each classroom's growing experiences and exchange interests. If you'd like to be included on the list, indicate so when you return the enclosed survey. For a copy of the list, send a stamped, self-addressed envelope to: Classroom Exchange, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.

Touch Your Plants? A Ticklish Question

Try telling your students that in addition to watering and fertilizing their classroom plants, they might consider tickling them from time to time. You may get some quizzical glances.



The discovery that touch can affect how plants grow was accidentally made by two Stanford molecular biologists who had set out to study plant hormones. *Discover Magazine* (Jan. 1991) reported that after spraying a particular hormone on a plant in the Mustard family, the researchers noted that five genes were activated. They found, much to their surprise, that the same genes were activated when the plants were sprayed with water, touched with fingers, or blown with a hair drier. They also observed concurrent changes in plant growth. When they kept up these treatments over three weeks, the touched plants were stocky and sturdy and grew to an average of 7 inches. Untouched "control" plants were more spindly and grew to an average of 16 inches.

Why might plants be tickled to toughness by touching? Consider the challenges of outdoor living. You and I can find shelter from strong winds and rain, but plants are rooted to one spot for a lifetime. Tall, spindly plants could snap in strong winds and harsh weather, while shorter, sturdier plants have a better chance of survival. The researchers theorize that this response to mechanical stimulation helps plants adapt to harsh outdoor conditions.

Do all plants respond in the same way? Do different types of stimulation (touch, water, wind, etc.) affect plants differently? How might the nature or frequency of touch affect plant growth? Do plants in exposed outdoor locations seem to grow differently than the same types in more protected areas? These are some questions yet to be explored.

Why not share these questions and invite your students to brainstorm some of their own? Consider using the Problem Solving for Growing Minds process (described on pages 10 and 11 of *GrowLab: Activities for Growing Minds*) to help students design investigations of their questions.

Be sure to share with students that these researchers stumbled on this discovery accidentally. Remind them, when conducting experiments, to keep open minds and be prepared for the unexpected. Some of the world's most important scientific discoveries have been accidental. Remember penicillin?

This project was supported, in part,
by the
National Science Foundation
Opinions expressed are those of the authors
and not necessarily those of the Foundation

Green Tips

Seeds in Fall—Collect 'em All

Growing plants from seeds pictured on bright packets is great fun, but have you considered the potential for excitement and discovery in collecting and planting unknown treasures from the meadows, overgrown lots, or woods in your school environment? Fall is the time when many trees, shrubs and wild plants release their seeds--making it a good time to explore their many dispersal strategies and collect them for planting in your classroom garden.

To increase your chances for successful germination, it helps to first think about the needs and adaptations of seeds in the wild.

Although some seeds produced during the summer or fall will germinate as soon as they disperse from their parent plant, think about the implications, particularly in colder climates, of this behavior. If seeds of plants that thrive during the warmer growing season were to germinate when they fell to ground in the fall, the seedlings would likely be killed by the cold winter temperatures.

Seeds of many wild plants have adaptations that ensure *dormancy* until conditions are right for successful germination. Many actually require a period of cold (winter) temperatures followed by (spring) warmth, to germinate. Some seeds have hard seed coats which, during alternate freezing and thawing conditions, will soften up and germinate. You can simulate both of these conditions...but first, you'll need to collect seeds.

Collecting Seeds

Most of the wild plant seeds you collect will be mature or ripe about 4 to 6 weeks after they've flowered. You'll have the best chance of success if you harvest seeds when they're ripe. A change in fruit color (from green to brown or black), and a sign that they're ready to disperse are indicators that they're mature.

To collect seeds from cone-bearing trees, harvest cones before they've opened all the way. Put each cone in a plastic bag and place it in a warm spot until the seeds can be shaken loose.

Have your students keep careful records about the growing conditions of the plants from which you collect seeds, so they can plant them in the spring. Is it sunny? Shady? A wooded area? An open field? Also predict the springtime conditions in each location.

Never collect seeds of any plant that seems to be in short supply in a given area. Ensure that there are plenty to continue producing seeds for new generations

If you're not planting the seeds or giving them a cold treatment right away, dry them in an area with good circulation for several weeks and store them in a refrigerator or other cool, dry place.

Breaking Dormancy

Some seeds require no special treatment, and others may require one or more treatments to break dormancy. Before experimenting with different seed treatments, consider simply soaking the seeds overnight and placing them on moist paper towels in a plastic bag. They may germinate with no additional treatment.

Consider experimenting with the following treatments:

- **Scarring.** Some seeds with hard coats, such as honey locust, will germinate more successfully if you use a file or sandpaper to scar the seedcoat. Be careful not to go deeply enough to injure the embryo.

- **Soaking in hot water.** Some seeds with hard coats, such as lupines, do best when placed in boiling water briefly and left to soak in the cooling water overnight before planting.

- **Moist chilling or *stratification*.** Most seeds dispersed in the fall have internal dormancy, requiring a period of cold before they'll be ready to germinate. If directly planting or soaking and planting seeds doesn't result in germination, consider simulating winter conditions by placing seeds:

1. in a bit of of damp peat moss or vermiculite in a plastic bag, OR
2. in moist sand in a covered glass jar, OR
3. directly into soilless mix in pots placed in a plastic bag.

In all cases, keep seeds in the refrigerator for one to four months before removing and planting. Check from time to time to make sure the mixture remains moist.

(continued)

Growing Ideas is published three times a year by the Education Programs Department of the National Gardening Association. *Growing Ideas* provides instructional ideas, horticultural information and a forum for exchange among teachers using classroom gardening to stimulate learning.
For a complimentary issue of *Growing Ideas*, write to: *Growing Ideas*, National Gardening Association, 180 Flynn Avenue, Burlington, Vermont 05401, or call (802) 863-1308. FAX (802) 863-5962.
Editor: Eve Pranis

Planting Wild Seeds

One of the most common problems in planting wild seeds is planting too deeply. Tree seeds should be planted about 3X as deep as the seed diameter; wildflowers about 1X as deep as the diameter; very fine wildflower seeds and grass seeds should be gently pressed into the soil without being covered.

Some require light to germinate, some require dark, and others will germinate with either. You might want to experiment with several different light conditions.

To grow to maturity, most wild plants require cooler nighttime temperatures than are likely found in your school. After two to four months of growing indoors (or when springtime arrives!) you should transplant them outdoors.

Gardening Grants Available

If you have plans for an outdoor gardening program with your class or other youth group, you're invited to apply to The National Gardening Association's 1992 Youth Garden Grants Program.

Because we believe in promoting science literacy, community involvement, and environmental responsibility through gardening, we are collaborating with garden industry companies to support garden-based education. In the spring of 1992, we will award up to 100 school and youth groups nationwide with: tools, seeds, bulbs, an award plaque, and educational resources to support their growing efforts.

We're seeking either new or existing gardening programs that have:

- a committed leader who can demonstrate long-term program sustainability,
- community and neighborhood support (e.g., financial assistance, materials, volunteer labor and recognition)
- a creative focus (intergenerational project, environmental investigations, sharing with community food programs, etc.), and
- interdisciplinary educational objectives

Past grant-winning programs range from a small, inner-city elementary school garden used to inspire creative writing, art projects and hands-on science experiments, to a junior high school farm program that focuses on life skills and supplies the school cafeteria with produce. What all winners have in common is a commitment to using gardens to stimulate curiosity, hands-on learning, and environmental awareness.

For a grant application, guidelines, and eligibility criteria, write to Garden Grants, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401 or call (802) 863-1308.

Do Plants 'Eat' Soil?

(Students' Preconceptions)

Students come to the classroom with ideas about their world, shaped by everyday experience, language, and imaginations that fill in the gaps. Do your students believe that plants suck up food from the soil? Or that trees are not really plants?

Boston first-grade teacher Karen Gallas reports that one student brought in a toy motorcycle, expecting it to grow if planted. Meg Richardson, a teacher liaison for a plant-based curriculum in New York, shared that during a unit on plant parts, students unanimously stated that all roots are brown.

Rather than try to "correct" students' understanding, these teachers provided hands-on opportunities for students' ideas to be tried out, challenged, and perhaps, modified. Karen invited the student to plant, tend, and observe his motorcycle over time. The students in Meg's story pulled bean sprouts from the soil, cleaned, and observed the white roots. "And they still said that roots are always brown," said Meg. "It was real evidence as to how strong our own preconceptions can be." She contends that continued exposure and varied experiences over time are important for students to develop frameworks for understanding. As students have opportunities to explore, describe, draw, and taste different types of roots (carrots, beets, sweet potatoes), for instance, and discuss their beliefs and experiences, they should begin to modify their conceptions.

Not all concepts, of course, can be explored through hands-on "discovery." Students need added support for understanding some concepts (e.g., photosynthesis), through such activities as discussion of observations. others' ideas, and readings.

What preconceptions do *your* students have about plants? How do you help them explore and modify their ideas? How have activities in *GrowLab: Activities for Growing Minds* helped you identify students' ideas? Use the enclosed survey form to share your experiences with our growing network.

Biosphere in a Bottle

What insights can a jar full of mud and water give us about life on planet Earth? Can an ecosystem within a jar teach us about the Earth's biosphere? Consider inviting your students to set up windowsill or GrowLab investigations to explore these questions.

The *biosphere* is Earth's surface region, including the land, water, and atmosphere, that supports all life on the planet. It's a closed system, with materials such as hydrogen, oxygen, nitrogen, and other elements constantly recycling. The energy flow, however is open--with energy from the sun constantly entering and dissipating through the atmosphere over time.

A humble jar of pondwater can act as a 'microcosm' of larger systems, similar in its makeup and function. It will contain *producers* (mainly algae and higher plants) that use light energy to manufacture food for themselves and for all other living things. It will also contain *consumers* (tiny animals) and *decomposers* (bacteria and fungi), that "live" off of energy captured by producers. Carbon, oxygen, and other important elements cycle through the minibiosphere, as in the larger world, through processes of photosynthesis, respiration, and decomposition. Windowsill sunlight or GrowLab lights can provide light energy.

Minibiospheres can provide an engaging focus for longterm observations, an understanding that systems cycle and change over time, and a glimpse into the tremendous diversity of life in even a small jarful of pondwater.

The grace of this type of project is its appropriateness to a range of grade levels. Lower levels may simply observe and describe changes over time and wonder at the diversity of emerging life. Older students can do more quantitative measuring and identifying of life forms. These minibiospheres also provide an opportunity to set up experiments to test the effects of simulated environmental changes on the system.

Biosphere Exploration

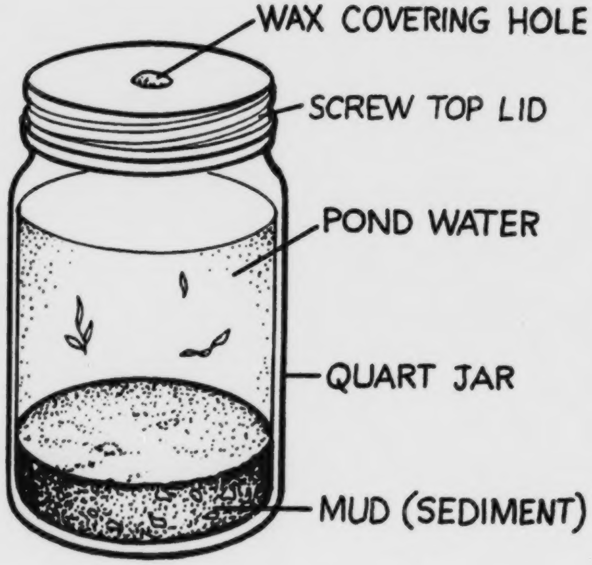
Consider breaking into small groups, with each group of students setting up several minibiosphere jars. If you'll be experimenting with various experimental conditions (described below), one jar can be the control, and the others the experimental jars.

Denise Martin, biologist and teacher education instructor in Burlington, Vermont, suggests the following minibiosphere setup, which uses readily available materials.

Biosphere setup

1. For each minibiosphere, obtain a clean pint or quart jar (e.g., mason jar) with a screw-top lid.

2. Because too much organic matter in the jars can cause a gas buildup and potential explosion, use a nail to poke a hole in each lid and seal the hole with melted wax. This will act as a pressure-release valve.



3. On your own or with your class, collect water from a pond or lake. Fill each jar 2/3 - 3/4 full with the pondwater and 1/2" to 1 1/2" of mud from the bottom. You may want make a point of collecting some visible primary producers (algae and plants) and consumers (snails and insects). Don't include large animals or plants since it's such a small habitat.

Make your pondwater collections at any time of the year. Denise Martin reports that her students were awestruck as tiny green plants and baby snails "hatched" from seemingly lifeless mud and water collected during the winter.

4. To observe what hapens when more producers are introduced, you can purchase and introduce a plant called *elodea* from an aquarium store. Although this isn't necessary, and it may be more exciting to see what emerges from the pondwater, you may choose to add some to just a jar or two for comparison.

5. Before sealing the jars, have students make careful observations of the contents. Use hand lenses and microscopes, if available, to explore the pondwater. Suggest that students also observe and use crayons or pencils to record the color of the water--or the amount of light passing through. The density of the green color is an indicator of the quantity of producers present, which will change over time.

Although, ideally, these systems should remain closed once they've been set up, Denise relays that student interest will be higher if they can open them briefly on a regular basis and remove a small quantity of water for closer observation. Have students observe changes in the abundance of different organisms, color changes, odor, etc.

Simulated Environmental Changes - Your class can simply observe and record changes in their jars over time, or may introduce an environmental change in some jars, to compare with control jars. (See Problem Solving for Growing Minds, described on pages 10 and 11 in *GrowLab: Activities for Growing Minds.*) Some suggestions follow. Have students use their imaginations to come up with their own ideas!

- 24 hours of light vs. natural (12-14 hours)
- low pH versus actual pond pH (simulated acid rainfall)
- no light (cover with black paper)
- addition of small quantities of fertilizer (simulated fertilizer runoff)
- cold versus warmer temperatures
- addition of salt (simulated road salt runoff)
- addition of commercial phosphate detergent (simulated pollution)
- colored cellophane around jars (growth under different light colors)

Duration - We recommend continuing observations for at least six weeks, although many will reach some state of equilibrium and remain healthy for months or years. While this type of activity has no right or wrong answers, we hope that it sparks more questions and stimulates further research and explorations. Students should develop an increased appreciation for the role of plants in transforming light energy into the food energy that sustains all life on Earth.

GrowLab Biosphere

Beth Yorio's elementary students set up an entirely different biosphere simulation. They built a 5'X5'X3'-wide wooden light unit enclosed with glass. After studying different ecosystems, the 21 students in the young astronauts program decided to simulate a biosphere that included rocks, soil, rainforest vegetation, and a hamster.

"It was a real learning experience," said Beth, "The kids researched and were involved in every phase of the process. They worked in groups to approach nurseries and pet stores for information and donations. We built the unit together from donated materials."

Are there other budding biosphere simulators out there? Let us know about your experiences.

Spread the Word

Presenting GrowLab

When Craig Esbeck, a school science coordinator in Minnesota, went to the state Science Teachers' Association Convention, he took GrowLab with him--not a 90 pound GrowLab, but information and activities to share with other teachers in an hour-long presentation.

Because we are a small staff with a large commitment to promoting garden-based learning, we rely on enthusiastic educators like you to help spread the word to your colleagues.

If you've discovered the value of hands-on, garden-based learning and would like to share your experiences, via a short presentation, with educators in your area, contact us for help. We'll be happy to send you a **GrowLab Awareness Presentation Packet**, which contains suggestions for an agenda, sample activities, and information on GrowLab resources.

We are also seeking educators who would like to develop longer inservice workshops and courses designed to improve hands-on science teaching. Thanks to the availability of increased Eisenhower funding to every district in the country, it is possible to be paid to help colleagues learn about plant-based science instruction.

If you would like help planning a GrowLab course or inservice, write or call Nell Ishee, our Coordinator of Educational Training at (802) 863-1308. If you've already conducted GrowLab presentations or workshops, use the enclosed survey to fill us in.

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Exchange

Wild Over Wildflowers

As part of a statewide educational program to develop a thematic science program; attract butterflies; and replenish wildflowers in the state, GrowLab students and teachers in Delaware went "wild over wild flowers this year.

With guidance from resource educator Stephanie Wright, material donations from Dupont, and support from everyone from a Brownie troop to the state Solid Waste Authority, 150 classrooms raised a range of wildflowers indoors and out. While non-GrowLab classrooms directly sowed seeds outdoors, GrowLab schools were able to start, observe, and care for them indoors.

"Since we're aware of a decline in monarch butterflies in the state" reported teacher Emily Barkert, "we were particularly interested in reestablishing plants that would attract them." A local Brownie troop collected enough milkweed seeds and a state wildflower expert collected enough Joe Pieweed seeds for 150 classrooms. Local nurseries and garden clubs donated other wildflower seed mixtures.

Participating students learned, firsthand, some lessons about adaptations for survival. After having no germination success with milkweed seeds, Emily Barkert's third graders considered the conditions these seeds would ordinarily undergo outdoors. They tried freezing some of the seeds to simulate cold winter conditions, and were rewarded with successful germination.

Once flowers were large enough to move, students transplanted them outdoors. "The kids were so excited to watch these flowers grow and to care for them," says Emily. "As each one blooms--poppies, black-eyed Susans, bachelor's buttons--the children all know whose it is, and share in the pride and excitement. We had already studied life-cycle stages. Now they apply that to their own flowers...noticing how their fruits form and how they disperse. It has really helped kids sharpen observation and discrimination skills. They can tell the difference between garden weeds and their own planted wildflowers."

The wildflower project also resulted in an exciting partnership between the wildflower classrooms and the state Solid Waste Authority. The waste authority has developed a "compost" made from solid waste and sewage sludge, processed under heat to kill weed seeds and pathogens. This nutrient-rich material was used for indoor experiments, with outdoor gardens, and in an innovative wildflower "turf"-type mat.

"Kids handled their first failure with the experimental soil well, " said one teacher. "They brainstormed what might have been the problem, adjusted the soil, planted again, and had success. They understand that this process is an important part of real science."

Other state solid waste programs have developed nutrient-rich growing media from waste products. Consider contacting the appropriate agency or corporation in your state. It could lead to an engaging gardening project that helps students explore waste recycling in a real-life context.

To receive information on native species or plant nurseries in your state, butterfly gardening, or collecting wildflowers, contact: National Wildflower Research Center, 2600 FM 973 North, Austin, Texas, 78725, (512) 929-3600.

School Offers NASA Seeds

Although NASA is no longer distributing packets of tomato seeds that spent six years in space, students in Burtsfield School in West Lafayette, Indiana, are offering seeds gathered from their garden full of "space" plants. Thanks to advice from scientists from Purdue University, the students cleaned several hundred thousand tomato seeds through a fermentation process.

While few dramatic differences between earth- and space-based tomato plants have been noted by professional and student scientists, it's believed that mutations are more likely to occur in the second or later generations of plants.

To receive a free packet of 2nd generation "space" tomato seeds, send a stamped, self-addressed envelope to: Burtsfield School, 1800 N. Salisbury St., West Lafayette, Indiana 47906.

Hydroponic Happenings

We've been pleased to learn that the suggestions in the last issue's "What, No Soil?" article captured many of your imaginations. Lottie Hodgeman writes that her sixth graders in Santa Ynez, California, had the best hydroponic luck with beans, flowers and lettuce. "Students were intrigued by the concept," said Lottie, "and the hydroponic gardening branched into conjecturing and researching how this technology might be useful in space or in underground (submarine) living situations."

Pat Pierce's fourth graders in Bristol, Vermont, grew lettuce, basil, and marigolds in four different hydroponic setups--and compared each with a control soil-based planting. They recommend old cotton socks as the perfect wicks for the glass jar hydroponic setup!

In Culpeper, Virginia, Terry Osborn's high school students built their own hydroponic unit from scratch and used old water from their fish tank for growing hydroponic lettuce. After having limited lettuce success and a great deal of algae growth, they discovered that covering rockwool with black plastic and poking holes for the plants will keep down algae growth by blocking light. They turned what might have seemed a 'failure' into a learning experience, and are ready to try again this fall.

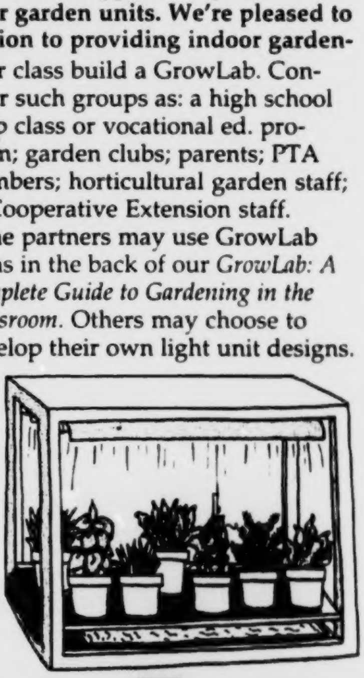
All of those who have written to tell us about their hydroponic experiences have expressed interest in learning from other classrooms. If you've explored hydroponics, please use the enclosed survey to share your experiences with our growing network!

Growing Partnerships, Building GrowLabs

School budgets are tight all over; but that hasn't stopped many teachers from finding a way to get a hold of indoor garden units. We're pleased to hear about community partners who, in addition to providing indoor gardening advice to GrowLab classrooms, are building or helping teachers to build indoor gardens.

Bibby Moore, Education Director at the North Carolina Botanic Garden, has helped 75 local teachers build GrowLabs, costing only $120 each, for their own classrooms. "Teachers had a tremendous sense of accomplishment," said Bibby, "and boy were their students impressed." She bought materials wholesale, contracted to have materials precut, and worked with teachers in teams of two to put together units in a three-hour session.

If you're yearning for a classroom light garden, but short on funds, consider approaching potential partners who could build or help your class build a GrowLab. Consider such groups as: a high school shop class or vocational ed. program; garden clubs; parents; PTA members; horticultural garden staff; or Cooperative Extension staff. Some partners may use GrowLab plans in the back of our *GrowLab: A Complete Guide to Gardening in the Classroom*. Others may choose to develop their own light unit designs.



K-6 Gardening Curricula

Indoor and outdoor gardening play a key role in the newly revised K-6 science curriculum of the Pittsford, New York, school system. Science Coordinator Wendy Seanor feels that a goal of developing a strong environmental strand made the gardening focus a natural for their curriculum. While lower primary grades focus on exploring life cycles and raising plants from seeds and plant parts indoors, upper grades use the gardens and outdoor nature areas to learn ecological principles through such activities as composting, raising worms, testing soil, and investigating acidity of rainwater.

With support from the PTA, parents, and money from an American Chemical Society P.A.C.T.S. grant,* schools are developing ponds, nature trails, and a greenhouse to serve as science laboratories.

Please let us know if you're trying to integrate indoor and/or outdoor gardening into your school- or district-wide curriculum. If it's an idea that interests you, contact us – we'll try to put you in touch with other educators in our growing network who can share their experiences.

*** Grants Available:** The American Chemical Society's PACTS (Parents and Children for Terrific Science) grants are available for pre-high school projects that involve adults and children in hands-on, inquiry-based science activities. The deadline for applying for the next round of grants is September 30, 1991. For an application and details on the grant, write to:
American Chemical Society, 1155 16th St., NW, Washington, DC 20036 or call (202) 872-4600.

Resources

Thanks to support from the National Science Foundation, we're continuing to develop resources to support your growing efforts and to lend fresh ideas to your plant-based explorations.

GrowLab Resource Videos for Teachers

Elementary teachers and students from New York to California helped us develop two engaging teacher resource videos.

"INDOOR GARDENING--ADVICE FROM GROWLAB CLASSROOMS." This 35-minute video guides you through the basics of successful indoor classroom gardening. Experienced classroom gardening teachers demonstrate how to engage students in everything from planting to pollinating cucumbers. Delightful student-produced clips (KidsVids) reinforce concepts from light needs to watering.

"PLANT A QUESTION--USING THE GROWLAB TEACHING CYCLE." Using actual GrowLab classroom footage, this 35-minute video portrays how to use the GrowLab teaching cycle as a framework for engaging science lessons. You'll see teachers using a variety of strategies--concept maps, brainstorming, controlled experiments, debates--to guide student-centered explorations. Student-produced "commercials" bring strategies such as designing a "fair test" to life.

Classroom Posters

SALAD CELEBRATION; SENSATIONAL SEEDS; THOSE AMAZING PLANT PARTS; and PLANT A QUESTION, WATCH IT GROW comprise our new series of lively posters designed to brighten your classroom and motivate your students with colorful illustrations, information, and challenges.

How To Order Videos and Posters

If you're already on our newsletter mailing list, you'll receive a free Salad Celebration poster and information on our other resources in September. If you're not on this list, but would like a free Salad Celebration poster and information on other posters, videos, and our resource books, check the appropriate box when you return the enclosed survey.

Growing Ideas
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Growing Ideas

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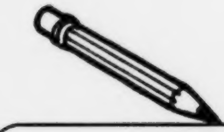

Sharing Your Experience
Seeking Article Authors

We're always interested in your activity ideas, partnership stories, and instructional suggestions for the pages of *Growing Ideas*, but we'd also like some of your efforts highlighted even more broadly. We'd like to help your stories get published through our contacts with national education and horticultural publications.

If you're inspired to write about a particular GrowLab science activity, teaching strategy, school-community partnership, or other topic, we'd be happy to receive a rough draft and take it from there. For an example of the types of teacher-written, plant-based articles we're describing, see pages 27-32 in the November/December issue of *Science and Children* magazine. We'll give you a $50 to $100 honorarium for articles that are nationally published.

To discuss or submit an article, contact: **Eve Pranis, Editor, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401. (802) 863-1308.**

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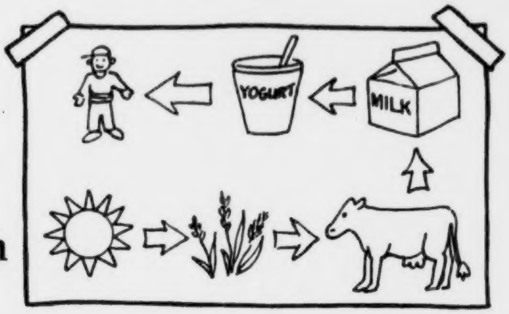
National Science Foundation
Opinions expressed are those of the authors and not necessarily those of the Foundation

Power Plants:

A Plant-Based Energy Curriculum



Making the connection between broccoli and the flick of a light switch may at first seem to be a stretch, but consider how useful plants can be in getting students thinking about energy concepts. After all, plants have the unique ability to capture the sun's light energy and change it to the chemical energy all living things depend on for food and fuel.

We get energy to fuel our bodies directly from plants, or from plants' energy as it passes through food chains. Much of the energy we use to run our cars, lights, and stoves comes from fossil fuels--formed millions of years ago as intense pressure caused plant and animal remains to turn into coal, oil, and natural gas.

A Vermont utility company, concerned about students' energy literacy and wanting to encourage energy conservation, funded NGA to work with teachers to develop a plant-based energy curriculum. The resulting 60-page curriculum activity guide, *Power Plants*, for fifth through eighth grade, will help you extend your plant-based activities to help students understand energy concepts from photosynthesis and energy in food chains to energy conservation in our food system.

Utility companies in your area, like several in Vermont, may be interested in sponsoring GrowLab programs that incorporate the *Power Plants* activities. We can help you approach utility companies, including providing plans for implementing a GrowLab Grants Program. For further information, contact the Education Department at the National Gardening Association.

To order a copy of *Power Plants: A Plant-Based Energy Curriculum*, send $5 to Power Plants, National Gardening Association, 180 Flynn Avenue, Burlington, Vermont 05401.

In the meantime, consider these suggestions for encouraging your students to think about plants and energy:

- Challenge your students to find a food energy source that doesn't depend on plants (Try keeping an itemized account of a typical school lunch and trace the food energy back to its source.)
- Compare the energy requirements of growing your own food vs. buying food that has been raised, transported, processed, and packaged before it reaches your table.
- Compare the ways in which plants use energy with the ways in which humans use energy.
- Experiment to find out what happens to a plant deprived of light energy.

Exchange

Get Wet With a Classroom Pond

W*etlands* was the Buchanan Middle School's science theme last year, so Bob Underly's seventh graders chose to rejuvenate a dried-up pond on their school's property. The students decided first to develop a model to observe up close, and the "classroom pond" concept was hatched.

The class tried to duplicate the sandy, loamy soils of the real pond bottom in a five-foot diameter indoor plastic swimming pool. Once the soil settled, students slowly added plants (horsetails, duckweed, lilies) donated by nature center staff, and carefully watched the system. They tested the water regularly for oxygen concentration (using methylene blue), and when it seemed high enough to sustain animal life, they introduced crayfish, frogs, and minnows, closely observing how they all interacted in the system. Because of the relatively small size and simplicity of the indoor pond, changes were rapid and readily observable.

The students worked in groups to keep records of all aspects of pond life, looking at soils, counting fish, and observing plants for signs of vigor or ill health. "In figuring the differences in depth, volume, etc., between the indoor and outdoor pond, and determining how much of which things to stock it with, kids readily used math skills," said Bob. "We also tied it in to social studies as we researched some of the historical uses (medicinal, etc.) of the local wetland plants."

The class is now taking cuttings of plants that are thriving in the indoor pond and propagating them in a mini-greenhouse so they can move them to the outdoor pond in the spring. "The kids are very excited to keep track of changes. Although we erected barricades, our frogs regularly escape which, of course, also enhances student interest! They love to sit around the pond and observe. Because it's tied in to a natural phenomenon nearby, they can relate it to their environment."

Bob would be happy to share his procedures, background information, and worksheets with others interested in aquatic adventures. **For a copy of Bob's wetland project packet, write to: Bob Underly, Buchanan Middle School, 610 W. 4th St., Buchanan, Michigan 49107.**

Hmmm... maybe a little to the left, next to the toadstool...
Pond Sweet Pond

LOAM DECORATING TIPS

GrowLab Pond

Science Specialist Dan Fitch reported that first grade teachers in his system were interested in tying their animal explorations in with their GrowLab efforts. With some help from Dan, several classrooms simulated natural ecosystems in the GrowLab. They used a board to divide their GrowLab bases into 3/4 land and 1/4 water, and lined the smaller section with double plastic. Vinyl tubing allowed them to drain the "pond" when necessary, and an aquarium-type pump provided aeration for the "pond."

"The kids became most involved," said Dan, "when they introduced a toad or frog which required care. The students researched the types of conditions and frogs need. Then they planted grass, taller beans for shade, and rocks to hide behind, directly into soil mix in the GrowLab. Students fed frogs meal worms and sowbugs. Bit by bit, they're adding crayfish and salamanders to the water and will soon experiment with aquatic plants.

"Kids were really fascinated by the behaviors," said Dan. "Many didn't know the difference between a frog and a toad, but after much observing did notice, for instance, that the frogs spent more time in the water while toads spent more time in the land portion of the mini-ecosystem. When the temperature or food supply was low, students noticed the animals burrowing as though beginning to hibernate." Dan recommends, if you try such a project, to seal your GrowLab tent with tape or magnets to keep frogs and other animals from exploring your classroom environment!

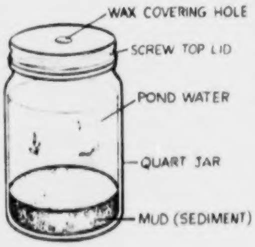
***Growing Ideas* is published three times a year by the Education Department of the National Gardening Association. *Growing Ideas* provides instructional ideas, horticultural information and a forum for exchange among teachers using classroom gardening to stimulate learning. For a complimentary issue of *Growing Ideas*, write to: *Growing Ideas*, National Gardening Association, 180 Flynn Avenue, Burlington, Vermont 05401.**

Editor: Eve Pranis
Contributors: Nell Ishee, Katie Barber

Classroom Biosphere Update

Carol Bacig and her sixth graders in Duluth, Minnesota, were inspired by suggestions in our last issue's "Biosphere in a Bottle" story. Using silty mud and local pondwater, each student filled and sealed his or her own biosphere jar and placed it on the windowsill. Regular observations kept students engaged as jars came to life with a diversity of plant and animal life. "The kids loved making slides, looking at the water under microscopes, and then projecting the image on the screen," said Carol.

Students wondered how light would affect their mini-biospheres, so they experimented by leaving three in the light and putting three in the dark. They next plan to test the pH of water using a pH scale, and to investigate how the biospheres would be affected by increasingly acid conditions.



"We've even tied the biosphere project in to art and writing," said Carol. "After viewing the pondwater under microscopes, I asked students to design an abstract art project based on pond life. An upcoming creative writing assignment is to imagine and describe being dropped into this ecosystem."

Are there any other mini-biospherians out there? We're eager to hear from those of you who have tried these in the classroom. For a copy of the "Biosphere in a Bottle" story from the last issue, send a stamped, self-addressed envelope with your request to the editor of *Growing Ideas*.

Garden-Based Literature--Early Primary

Amy Kjerrumgaard's first graders in Michigan have had the pleasure of exploring and tasting fruits, from A to Z. After reading Lois Ehlert's *Eating the Alphabet*, Amy's students got excited about locating and exploring every one of the 26 fruits described. "They were so eager to run with it," said Amy, "that I ran with them, and it developed into a year-long theme."

Each student published his or her own fruit alphabet book in which he or she drew, researched, and located the origin of each fruit on the map. "We would have a mystery fruit of the week," said Amy. "I was able to find everything from elderberries to Chinese watermelon (the name begins with x!) and would bring in two of each fruit. Students were blindfolded and asked to feel, describe, and guess which fruit was in a box. We'd cut open the second sample to taste, then we removed, dried, and mounted the seeds. We'd mount some seeds on index cards to play a concentration-type memory game. Others we'd use as math counters, and yet others we'd plant and observe."

Eric Carle's *The Very Busy Spider* provided a lively backdrop for the growing explorations of Jim Olson's kindergarteners in Minnesota. After reading the book, students made spider puppets, and Jim brought in a spider plant. His students, deducing from the plant's appearance, were able to name it correctly. Each student then planted his or her own baby spider plantlet to care for at home. "The kids are very attached to their plants," said Jim, "and regularly report on their growth and progress."

There are a wide range of early primary books that can enrich your "growing experiences." Many of these are annotated in the bibliographies of both *GrowLab: A Complete Guide to Gardening in the Classroom* and *GrowLab: Activities for Growing Minds*. If you've discovered some children's books that complement your gardening activities that you don't see listed in the resource sections of the GrowLab books, please let us know. We'd like to share your ideas, and perhaps your book reviews, with others through the pages of *Growing Ideas*.

Where in the World...?

A simulated desert in Jan Model's Michigan classroom became a centerpiece for practicing mapping and geography skills. With support from a local horticulturist, Jan's seventh graders created a GrowLab desert environment in which they planted cacti and succulents.

The students worked in pairs to draw, describe, and measure their plants. Using materials from the library, students identified the plants in their desert environment and learned about their origins. From there, they located and marked the plants' origins and current distributions on their mural world map. "We're thinking about doing a similar project with a rainforest environment," said Jan. "It really helps the students visualize geographic diversity and is a great way to tie science and geography together."

You don't have to be simulating a particular ecosystem to tie GrowLab in to a geography/mapping lesson. Did you know that potatoes probably originated in Peru; lettuce from the Mediterranean area; cucumbers from India; radishes from China; watermelon from Africa? Consider having students trace and map the origins of whatever crops are growing in your garden. What do the areas of origin tell you about the conditions they require for growth? Find out some of the history of use of different food crops.

BEST COPY AVAILABLE

Garden Video Exchange

Students at Pillsbury School, a math-, science-, and technology-focused school in Minnesota, are participating in an exciting garden video exchange thanks to teacher/master gardener/storyteller Larry Johnson. Larry has engaged former students in creating their own garden video "letters" to share with other schools in places ranging from Finland to Georgia.

Larry's first and second graders would like to exchange garden video letters with other students. Interested? **Contact: Larry Johnson, Pillsbury School, 2250 Garfield NE, Minneapolis, MN 55418.**

Join the Exchange

More than 100 classrooms, wanting to share everything from native seeds to videos to experimental data with other gardening classrooms, are described in our *Growing Ideas* Exchange list. Due to the large survey response in our last newsletter, we will have an updated list available by mid-January. If you'd like to be included on the list, indicate so when you return the enclosed survey. For a copy of the list, send a self-addressed envelope with .52 postage to: **Classroom Exchange, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.**

Scientists as Classroom Partners

As a parent and a practicing electrical engineer, Arlene Garrison has concerns about children's interest in science. She believes that students can benefit greatly from exposure to scientists and real-world science practices and challenges.

Arlene and another parent/scientist decided to support hands-on science education by volunteering time in their children's classroom. Every other week, participating students work with them on plant, earth, and physical science activities.

"I've seen some real changes in students during these two years," says Arlene. "Students, particularly female, were initially timid about 'science class.' They soon developed positive atititudes and began to cheer our arrival. When asked to draw pictures of scientists, rather than stereotypic pictures of lab-coated scientists with frizzy hair, many students soon drew female scientists solving real-world problems. The students' science test scores improved, and their questions and interest increased."

Said participating fourth grade teacher Margaret Butt, "I plan to do more of these hands-on explorations in the future. The students are much more open to brainstorming and taking risks now that they understand there is no one right answer in scientific exploration."

Increasingly, companies are concerned about the scientific literacy of our future citizens and workforce. Consider inviting a guest scientist to share some activities and experiences with your class, to humanize your students' concept of scientist.

How about contacting local companies or inviting parents who might be in scientific professions? Many professionals could relate to your "growing" experiences--consider scientists working in nurseries, hospitals (e.g., dietitians), universities, or environmental agencies.

Green Tips

Lunching with Ladybugs

Assume your eagle-eyed classroom observers notice a collection of those sucking little pests, aphids, on the leaves and stems of your classroom garden plants. What should you do? The horticultural guide, *GrowLab: A* *Complete Guide to Gardening in the Classroom*, will tell you not to worry—(a.) pesky pests won't necessary spell the end of your indoor garden plants, and (b.) you can control aphids to a point using a soapy water spray or wash.

We've heard from a couple of educators around the country who have taken yet a third approach. They've turned the appearance of garden pests into a wonderful opportunity to observe and learn about food chains, and plant/animal and predator/prey interactions.

Increasingly, commercial greenhouse growers, homeowners, and farmers are taking advantage of existing natural relationships and using "beneficial" insects to control garden pests. Although timing, life cycle stages, and environmental conditions must be right (and this can be a challenge), introducing beneficial insects can provide an exciting science focus for your class.

Ladybugs--aka "Aphid Wolves"

Sharnell Jackson, a third grade teacher in Chicago, told us that she had actually imported aphids from a science supply catalog, as part of a plant and animal populations unit. When the aphid population exploded and threatened GrowLab plant health, the class ordered ladybeetles as well.

Who would believe that the cheerful, gentle ladybug (technically, not a bug, but a beetle) will eagerly eat more than 5,000 aphids (along with white flies, mites, and indoor garden pests) during its year-long life?! Ladybeetle larvae, in fact, known to eat as many as 40 aphids per hour, have earned the nickname "aphid wolves."

"Students were fascinated," said Sharnell, "to explore and experiment to see what the ladybeetles preferred to eat. We kept them in small vials and added different types of aphid-covered leaves. When we let the ladybugs out in the GrowLab, they first stayed on the plants, but tended to fly to the windows as the food supply dwindled. The kids really gained an understanding of food chains, and how we can mirror nature to protect our plants without using harmful chemicals."

Ladybug Tips

Enthusiastic gardeners have sometimes released ladybugs as predators only to have them fly off and disappear.

To improve the chance that your ladybugs have been collected at the stage when they're hungriest, consider ordering them from a science supply catalog or a company specializing in beneficial insects. We've listed a source that has offered to sell ladybugs at cost to *Growing Ideas* readers.

As wild creatures, ladybugs will leave if they don't like their new environment. If they have no way out, they'll tend to collect around the windows and die. The following suggestions will encourage ladybugs to stick around your classroom:

- When they arrive, you can store them for up to two months in the refrigerator and release them in small batches (20-30) rather than all at once. Spritz them with water once a week to keep them alive while in storage.
- Since they won't fly at night and do require a "settling down" period, release them into the area near dusk. Sprinkle the area with water to give them a drink.
- If you have a GrowLab with a tent, consider sealing the edges of the tent with tape or Velcro. Alternatively, place a large plastic bag or tent over selected "infested" plants and introduce the ladybugs into that restricted area.
- Some insectaries suggest that you spray ladybugs lightly with a solution of half water, half soda, to seal their wings shut for a week or so to keep them in a particular area.
- Many catalogs that have ladybugs also carry a food supplement (whey, yeast, and often sugar) to spray on boards or plants to keep ladybugs around when the aphid supply is low. Although you won't need a supplement for pest control, they will need additional food (naturally supplied by nectar and pollen) if you want them to breed.

Of course, aphids aren't the only pests that ladybugs will eat. Your students will no doubt have plenty of questions and make lots of discoveries should you lunch with ladybugs. We're eager to hear about your experiences.

Catching Your Own

If you choose to catch your own ladybugs, it's best to bring in young beetle larvae in the spring from the garden. Resembling alligators, the tiny black larvae emerge from clusters of yellow eggs attached to leaf undersides. After feeding for a few weeks, a pupa (black with red markings) forms on the upper leaf surface. In five to seven days, an adult emerges.

Ladybug Special Offer

Gardens Alive!, a natural gardening company in Indiana, has offered to supply interested *Growing Ideas* teachers with ladybugs at cost. For a half pint of ladybugs (enough for a school or district full of indoor gardens!), send a request and $4.75 to: Gardens Alive! 5100 Schenley Place, Department 2545, Lawrenceburg, IN 47025. You can also phone in your order to (812) 537-8650. Be sure to include the department number to get the special discount. They've also offered a special deal on green lacewings. For 1,000 Lacewing eggs and instructions for introducing them, send $2.50 with your request to Gardens Alive! at the above address.

Praying Mantid Antics

Paul Johnson, a horticultural educator in Vancouver, recommends praying mantids as fascinating classroom "pets" and indoor garden protectors. They've successfully raised praying mantids for some time in Vancouver greenhouses for use in first through seventh grade classrooms. Paul says that although only the young praying mantids will feed on aphids, whiteflies, fungus gnats, and other garden insects (the older ones prefer crickets), the kids were enthralled by the whole process. "Every morning the kids rushed in to observe them, to see if they'd molted or changed. They measured the mantids' growth, determined how much and what types of foods they ate, and noted how they changed over time."

Paul says each cycle begins as the female, using saliva, spins a cocoon. When the young emerge, the more dominant ones may cannabilize some others for a short time. Paul recommends separating the young and keeping each in a plastic container with perlite or vermiculite in the bottom. Put bread crumbs, or some mites or other insects in the bottom for mantis food. You can also feed young mantids bananas and other soft fruits.

Mantid Cocoons Available

Because he's had such success, and has some 30 cocoons right now, Paul wants to make them available to other educators. He has offered, on a first-come, first-serve basis, to send praying mantis cocoons to teachers who would like to try raising some in their indoor and/or outdoor garden. **To order a cocoon, send your request with an international reply coupon (available for .95 from all post offices) to: Paul Johnson, c/o Vancouver School Board, 2600 E. Broadway, Vancouver, BC, Canada V5M 1Y5 or call (604) 255-8941.**

Herbal Adventures

Herbs...the green flecks in spaghetti sauce, the soothing late night teas, the dried mixtures that keep the bathroom air fresh. But did you know that many prescription medicines contain drugs derived from natural herbs? Or that many perfumes and other fragrances are made from the oils in herbs?

Herbs have been used for at least 5,000 years by all cultures for cooking, medicine, crafts, and cosmetics. Many herbs are easy to raise in the classroom. Herbs have such rich histories and so many uses that they can provide an enticing, multi-sensory theme for learning science concepts and skills, studying other cultures, and tying in subjects across the curriculum.

Activities: What Makes an Herb an Herb?

Commonly, "herb" refers to any plant or plant part valued for its medicinal, savory, or aromatic qualities. In many cases, herbs' oils and compounds that cause healing, good flavors, or aromas, are merely adaptations that help the particular plant survive in its environment. Humans take advantage of these plant adaptations for our own uses much as we take advantage of flowers (adaptations for pollination) for their beauty.

Consider doing some activities to engage your students in identifying some of the characteristics that make an herb an herb. Some examples follow:

- Have students use their senses to compare six potted plants including, for instance, a spider plant, parsley, jade, rosemary, lettuce, and thyme. Then ask them to organize the plants into groups with similar attributes, and let other classmates guess how the groups were categorized.
- Have students taste six edible leaves—spinach, basil, lettuce, rosemary, thyme, and cabbage—and describe the tastes of each. Ask: *Which ones might you eat a bowl of? Why or why not? How could you imagine using the others?*
- Invite students to try to match aromas of fresh herbs with dried.
- Share with students the fact that herbs contain oils which create the odors and flavors we experience. After smelling several herbs, have students guess how such odors might help the plants survive in their environment? (Hint: the odors can both attract helpful insects and repel "pests.")

Growing Classroom Herbs

Many herbs can be easily grown in a classroom light garden or windowsill, started from seeds, cuttings, or plants. Local nurseries, friends' gardens, and catalogs are good sources for herb seeds and plants. For detailed information on growing plants from seeds and cuttings, see *GrowLab: A Complete Guide to Gardening in the Classroom.*

...from seeds...

Plant herb seeds in the same soilless potting mix you use for other indoor plants, or plant them in a mixture of 1/3 sand, 1/3 peat moss, and 1/3 soil. Most herb seeds are small, and should be planted no more than 1/4" deep in moist soil or sprinkled on the top of soil and covered lightly with potting mix. You can have children mix tiny seeds with a small amount of sand to make them easier to sprinkle over the soil. Mist the soil, and cover containers with plastic to keep seeds moist until they germinate. To give herb plants room to grow to maturity, thin seedlings to one per 4" container or 2 plants per 6" container.

...from cuttings...

Some herbs are quicker and easier to start from cuttings than from seeds. To take cuttings, snip healthy stems 3-4 inches from the growing tip. Remove leaves from the lower half of the cutting, and plant the cutting in a soilless mix. Water gently and cover the container with a plastic bag until new top growth appears.

...from plants...

Many herbs can be purchased from nurseries as young plants, or dug, particularly in the spring, from the new shoots emerging from mature plants outdoors.

Cultural Ties

Elba Marrero's special education students in NYC discovered that one of their classroom plants, Rue, is used medicinally in their Hispanic culture. Combined with alcohol or oil, it is a liniment for aches and pains. "I can't tell you how exciting this has been for my kids," said Elba, "It's been a special way of making connections with their culture. We've also made herbal sachets which we've sold at school and sent home. Others' interest in their project has really boosted their self esteem. They have even been corresponding with and are receiving suggestions from an author of herb books."

Indoor Herb Growing Chart

herb	days to germination (from seed)	how to start it
Aloe	----	plants
Basil	5-10	seeds or plants
Caraway	14+	seeds
Catnip	4	seeds or plants
Chives	7	seeds or divide plants
Chamomile	7	seeds or plants
Coriander	9	seeds
Cress	7 days	seeds
Dill	5	seeds
Fennel	6	seeds
Garlic	---	plant cloves as bulbs
Lavender	---	plants
Lemon Balm	7	seeds or plants
Nasturtium	5	seed
Oregano	30+	cuttings, plants, seeds
Parsley	20+	seeds or plants (soak 12 hrs. before planting)
Peppermint/Spearmint		plants or runners
Rosemary	20+	seeds or plants
Rue	7	seeds or plants
Sage	28+	seeds or plants
Summer Savory	5	seeds
Tarragon	----	plants
Thyme	20+	plants or seeds

To encourage bushier, fuller plants, pinch off new growth for smelling, tasting, or using in experiments.

Herbs Across the Curriculum

There are endless opportunities to tie language arts, math, social studies, science skills, art, and more in with an herb unit. Reflect on some of the varied uses, past and present, for herbs and consider how you might incorporate them into engaging cross-disciplinary activities. Some examples follow:

- Explore the use of herbs in different cultures and cook an international meal.
- Create a class cookbook of your favorite herb recipes.
- Cook two batches of spaghetti sauce, one with and one without herbs. Compare the tastes.
- Make aromatic herbal "sachets" or catnip toys from dried herbs in fabric pouches.
- Research and practice some herbal dyeing in your classroom. Indoor garden herbs that are good for dyeing include: catnip, marigolds, marjoram, morning glories, parsley, rosemary, sage, and zinnias.
- Devise ways to capture and retain the smell of one of your fresh herbs.
- Investigate whether cats really go wild over catnip. Grow some of this mint, then design a fair test to see if cats prefer it to other members of the mint family like peppermint, spearmint, and basil.

Mothers' Day Herb Books

Each fifth grader in Vermont teacher Pat Pierce's class got to adopt-an-herb to raise in their GrowLab. Students read seed package directions to discover how to plant and care for their herbs, made ongoing observations, and drawings, and researched history, folklore, medicinal, and culinary uses. "The kids were so personally attached to their herbs," said Pat. "They'd want to keep them on their desks, and were intrigued with the smells, textures, flavors." The students then went through a series of recipe books to find recipes with their particular herbs. Each student created a book which included drawings, observations, research reports, and a variety of recipes for his or her herb. The books and plants made informative, aromatic Mothers' Day gifts.

Free Herb Seed Collection

Shepherd's Garden Seeds has put together a special collection of herbs for *Growing Ideas* readers interested in herbal adventures. The collection contains packets, with growing instructions, for 6 herbs: basil, dill, chives, chamomile, curly cress, and catnip. To request a free herb collection, request item #5999 from: Shepherd's Garden Seeds, 30 Irene St., Torrington, CT 06790.

❦ Design a "smell test" using aromatic herbs to compare the abilities of different people to discriminate among them.

❦ Find out about the culinary, cosmetic, and craft uses of herbs by people in a time period or culture you're studying. For example: Pilgrims, Pioneer Days, Native American Life, Ancient Greece, the Middle Ages, the Victorian Era, etc.

❦ Herbs have been used for thousands of years to perfume our bodies and homes. They're used to cleanse, protect, and invigorate our skin and hair. Have students try some of the following:

- Survey soaps, shampoo, cosmetics, lotions in stores or in the house to identify herbal ingredients.

- Make scented oils by soaking fresh blossoms or leaves of herbs such as mints, lavender, or rose in vegetable oil. Remove the herbs after 24 hours and replace with fresh herbs. Continue this each day for a week. You'll have a lightly scented oil for skin and bath.

- Write to or visit a company that makes natural cosmetics to find out more about what herbs are being used today.

❦ In the late 1800s, chemists began isolating the chemicals in plants used for thousands of years by people to promote healing. Although many of these active chemicals are now created synthetically, new substances are constantly being found in plants and herbal remedies still used in some cultures. They're also being discovered in places such as diverse tropical rainforests.

- Create your own herbal recipes to cure common maladies, e.g., writers' cramp from too much homework.

- If the opportunity arises, devise a "fair test" to compare the effects of the juices of the aloe plant on burns to those of a commercially-made lotion.

- Interview a pharmacist to find out which medicines used today are made from plants

Herbs in Children's Fiction

Children's fiction can add a rich dimension to an herb unit. Such books can provide information, inspire creative writing, provide a basis for plays and puppet shows, and stimulate ideas for further activities. Here are a few recommended books:

***Rosy's Garden: A Child's Keepsake of Flowers* by Satomi Ichikawa. 48 pp. Gr. K-3.**

This beautifully illustrated book about Rosy's visit to her Grandmother's home is filled with poems and folklore about flowers; how-to's of pressing flowers, collecting seeds, making herbal pot pourri. It contains a section on herbs including recipes and history.

***Where the Lilies Bloom* by Vera and Bill Cleaver. 210 pp. Gr. 4-6**

This is the story of a family of children who, after their father's death, take up gathering and selling medicinal herbs to pharmacies. They meet many challenges in the harshness of the Smokey Mountains.

***Wise Child* by Monica Furlong. 228 pp. Gr. 5-6.**

Wise Child, set in Great Britain during the Middle Ages, features a 9-year old girl who is sent to live with a witch. As Wise Child overcomes her fears of the witch, she begins to learn about herbs and magic.

Other books to tie into herbal units recommended by teachers include: *The Cabin Faced West*, by Jean Fritz; *The Little House Series* by Laura Ingalls Wilder; *My Side of the Mountain* by Jean George; *The Secret Garden* by Sara Hodgson Burnett, and *Mandy* by Julie Edwards.

Thanks to NGA intern and teacher Katie Barber for the thorough research, writing, and creativity that helped to inform this article.

❦

Teacher Training and Support

Would you like to share your "growing experience" with others? Are you aware that Eisenhower Math and Science grant funds are available to every school district nationwide to pay for science training efforts? These funds have been used in many areas to provide GrowLab training for teachers. Contact your Superintendent's office to find out who determines how these funds are allocated within your school system.

GrowLab offers wonderful resources to help new and experienced teachers do more hands-on, inquiry-based science using plants. We also offer materials and assistance for teacher trainers and staff developers. Contact Nell Ishee at the National Gardening Association for the following:

- awareness presentation packets
- training support materials
- help planning a GrowLab workshop or course
- information on locating or becoming a GrowLab trainer

KEEP OUR NETWORK GROWING! ☑Survey

We're pleased to have you as a member of the growing national network of educators using classroom gardening to stimulate learning. Sharing your classroom gardening experiences can help make the network a useful resource for teachers nationwide, and will help us develop partnerships and resources to meet your instructional needs.

Please take a few minutes to complete this survey to inform or update us on your efforts. Let us know whether you'd like to begin or continue receiving **free issues of *Growing Ideas*,** and return the form to: **Editor, *Growing Ideas*, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.**

☐ If you are not a classroom teacher, but a "partner" working with educators, please check this box and fill in what's appropriate on the survey. We'd like to call to find out more about your efforts.

Name ____________________ Title ____________________ Grade __________

School/Organization ____________________ Street ____________________

City ____________________ State ______ Zip __________ Phone ____________________

☐ Please begin/continue my free subscription to *Growing Ideas.*

☐ Please send me information on your curriculum resource books, GrowLab Indoor Gardens, videos, posters and other resources. (You will automatically receive this if you'reon our mailing list and receiving this newsletter.)

☐ Send me your GrowLab Awareness Presentation Packet so I can do a presentation for teachers in my area.

1. Which type of growing setup are you using in your classroom?

☐ GrowLab (prefabricated)
☐ Other commercial indoor light unit
☐ Windowsills
☐ Other ____________________
☐ GrowLab (homemade from our plans)
☐ Other light unit (made from your plans)
☐ Greenhouse
☐ Outdoor garden

2. With how many students per year are you gardening indoors? __________ students per year.

3. If applicable, in what year did you start using GrowLab Program resources and/or equipment? ____________________

4. Which, if any, GrowLab Program resources have you used?

☐ *GrowLab: A Complete Guide to Gardening in the Classroom*
☐ *GrowLab: Activities for Growing Minds*
☐ *Growing Ideas* newsletter
☐ GrowLab training (by National Gardening)
☐ Introductory video, "A Growing Experience"
☐ Teacher resource videos
☐ GrowLab training by ____________________

5. From where did you get funds or donations for your indoor gardening equipment and supplies?

☐ school budget
☐ district or state grant
☐ local business
☐ corporate grant or donation from: ____________________
☐ other (describe below)
☐ chapter 2 funds
☐ PTO
☐ horticultural organization (club)

6. Briefly describe some of the activities that have been highlights of your classroom indoor gardening experience.

7. Describe ways in which your classroom gardening efforts have benefitted from outside support or "partners" (e.g., volunteers, material donations, funding).

8. What are some tools with which you assess what your students have gained from their growing experiences? Please describe some significant gains.

9. Our Growing Ideas Classroom Exchange is a forum for gardening classrooms to share information. If you'd like to be included in our Exchange pamphlet, list what your class would like to exchange with other gardening classrooms.

☐ pen pals
☐ specific experimental data
☐ classroom videos
☐ seeds (from local plants, special seeds, "space" seeds, etc.)
☐ classroom-produced videos
☐ other (please describe below)

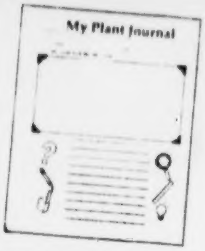
11. Have you given GrowLab presentations or workshops for other teachers? (Please describe.)

12. How did you hear about our GrowLab Indoor Gardening Program?

☐ state or national educators' convention (which one?) ______________________________
☐ mail brochure
☐ other teachers, curriculum coordinator, or science supervisor
☐ advertisement in ______________________________
☐ article in ______________________________
☐ other ______________________________

13. Please list names and school addresses of other teachers who might like to receive information on plant- and garden-based educational resources (attach another sheet, if necessary.)

Science Assessment: A *Growing* Challenge



Sure they're excited and having fun, but how does classroom gardening improve students' science and problem solving skills, content understanding, and attitudes toward learning?

We're all facing increasing national and local pressures to identify what students are really gaining from different instructional efforts. Although standardized paper-and-pencil-type tests have been the norm, more and more educators are recognizing the limitations of these tools. They are particularly inadequate for measuring gains from active, hands-on learning programs.

We reviewed 120 teachers' survey responses to identify what teachers believe students were gaining from garden-based learning, and to find out what tools teachers are using to assess these changes. (See the next issue of *Growing Ideas* for highlights of student gains.)

Tools Gardening Teachers Use to Assess Students

Your feedback indicates that you use a range of tools to gather data for assessing students' progress from their plant- and garden-based experiences. They include the following:

- **Journals/notebooks/drawings**
- **Observations of hands-on activities** (sometimes including informal checklists)
- **Individual and class discussions**
- **Students teaching/sharing with others** (One fifth-grade classroom planned and later videotaped a lesson for first graders.)
- **Observations and reports of cooperative learning groups**
- **Feedback from parents**
- **Dramatizations**
- **Participation in student-run businesses**
- **Paper and pencil measures**
- **Students' evaluations of their own plants and work**

We're eager to hear, via the survey form in this newsletter, how you assess what your students are gaining from plant-based explorations. We're collaborating with national evaluation specialists to identify alternative means of assessment that capture what students really gain from an inquiry-based program. Please send samples of your evaluation "tools" or results. Your suggestions can be valuable to fellow teachers and to science education policy makers.

Student Self-Assessment

We want to know which tools and procedures you use to help students evaluate their own learning. We'd like to design a sample self-evaluation rating sheet for intermediate grade students. If you're interested in trying out such a scale and/or in sharing ways that your students evaluate their own learning, please contact Nell Ishee at the National Gardening Association, or indicate your interest when you return the enclosed survey.

Suggestions for Assessing Science Skills

Since GrowLab strongly focuses on using science process and problem solving skills, consider asking yourself some of the following questions about science skills when reviewing student journals, observing individuals and groups, and engaging in class discussions.

Your questions will vary, of course, with grade level teaching objectives, individual students, teaching style, etc. You may want to design a checklist or card file to track each student's progress (via anecdotes, a continuum, or scoring procedure) in some of the areas that follow. Consider preceding each question with: *Is this student increasingly...*

OBSERVING

...using a range of senses in observing/investigating phenomena?
...identifying similarities and differences and noticing patterns between events, objects, characteristics?
...showing attention to detail in all types of observations?
...recognizing sequences of events?

RAISING QUESTIONS

...asking questions that could be researched or that could lead to investigations?
...showing interest in and following through on investigating his or her own questions?

COMMUNICATING/RECORDKEEPING

...displaying results accurately, using graphs, tables, charts?
...recording the process and results in an organized fashion?

PLANNING INVESTIGATIONS

...understanding what materials are needed to carry out investigations?
...recognizing what variable will change and how, and which will stay constant for a fair test?
...understanding what he or she should measure and compare?
...applying previous understanding or knowledge to help form hypothesis for investigation?

INTERPRETING INFORMATION/RESULTS

...correctly interpreting graphs, charts, etc., and using patterns to make predictions?
...using information gained through investigations to infer, draw conclusions, and develop new hypotheses?
...identifying factors that could have influenced results?
...identifying ways to improve investigations?
...avoiding overgeneralizations?

TAKING ACTION

...applying classroom learning to outside challenges and problems?
...seeking resources beyond the classroom to extend learning?

Resources

Seed Collections

Kathy Wildman, a nursery owner and educator from Sunbury, Ohio, is once again offering educators, for a minimal fee, collections of seeds donated by the Livingston Seed Company in Ohio. Each collection listed below, appropriate for indoor and/or outdoor gardens, contains at least 20 seed packets.

Flower Garden. A set of 20 mixed flowers including ones for drying.

Herbs and Edible Flowers. Includes savory, parsley, oregano, dill, nasturtiums, basil, and more.

Vegetable Garden. A potpourri of 20 favorite vegetable seed packets.

Mixed Surprise. A melange of herb, vegetable and flower seeds.

To Order Seed Collections...

Send a list of the packets you want and a check or money order for $5 for the first collection (20 packets) and $2.50 for each additional collection to: Kathy Wildman, 3977 Condit Road, Sunbury, OH 43074. Phone: (614) 965-2133.

Book Review

Hidden Stories in Plants, by Anne Pellowski. 1990. Macmillan Publishing, NY. 93 pages. (Teacher resource book for kindergarten through eighth grade.)

In *Hidden Stories in Plants*, the author weaves together simple but delightful plant myths and legends with equally delightful plant craft activities. The author's instructions for making dolls, musical instruments, disguises, toys, and ornaments reflect her appreciation of the variety and bounty of nature.

While a teacher can use the storie and activities independently, some nicely supplement activities from *GrowLab: Activities for Growing Minds*. The tales stretch students' abilities to think in analogies and would support, for instance, such activities as "Plant Private Eyes" and "What's in a Name." By calling students' attention to specific features of plants, these stories can enhance observation skills and complement investigations of plant part functions. Fables such as a Polynesian legend, "Why Most Trees and Plants Have Flat Leaves," might be read in conjunction with such GrowLab activities as "Look Out for Leaves" or "Turning Over a New Leaf."

Reviewed by Nell Ishee, NGA's GrowLab Training and Dissemination Coordinator

Growing Ideas

National Gardening Association
180 Flynn Avenue
Burlington, Vermont 05401

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A JOURNAL OF GARDEN-BASED LEARNING

Growing Ideas

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A GrowLab Winner in Chicago

"I can't tell you how delighted I am—our school budget covers so little and my students love planting and observing growing things so much," said Phyllis LoPiccolo, of St. Barbara's School in Chicago. Phyllis's third graders will now be able to raise thriving gardens year round in the GrowLab Indoor Garden their teacher won in our Growing Ideas survey drawing.

We thank all of you who continue to return our newsletter surveys and share your growing experiences and interests. Your responses help us plan future articles, connect potential funders and partners with gardening classrooms, and develop resources to meet your instructional needs. Please continue to keep us up to date.

GrowLab Presentations

If you have given any GrowLab awareness presentations, inservice workshops, or courses, or if you wish to do so, contact the Education Department at NGA for brochures, newsletters, and training suggestions. We would particularly like to assist with GrowLab presentations at state and regional educators' conventions.

This project was supported, in part, by the
National Science Foundation
Opinions expressed are those of the authors and not necessarily those of the Foundation

Getting Hooked on Worms

A million of them could live in an acre of soil. They can "eat" their own weight in soil and organic matter every day. They help recycle organic matter, making the nutrients available to plants through their rich castings, and they're easy to raise. With such potential for teaching environmental concepts, it's a wonder that more classrooms haven't gotten "hooked on worms." Here's one classroom highlight....

Zoo-Doo for Sale

The idea of creating a "biological garbage disposal" emerged when Sheana Godwin's RoseHill, KS, seventh graders brainstormed how they could positively affect their environment. After researching the needs (and abilities) of worms, Sheana's students obtained red wigglers from a bait shop, purchased 5-gallon Rubbermaid tubs, measured out 500 grams of worms, shredded weeks' worth of newspapers, and were in business.

These seventh graders worked in groups to collect and weigh trash daily from the cafeteria. After dividing the weight of the trash by the number of students eating at a given time, they tracked, graphed, and shared with fellow students how the volume of trash changed over time. The teams separated organic plant matter from other materials and fed it to the waiting worms. Said fellow teacher, Bev Leete, "We were all amazed with the wonderfully earthy-smelling soillike fertilizer—dubbed 'zoo-doo'—created by the worms."

Zoo-Doo Economics

Bev's class was so intrigued that they requested some zoo-doo to use in an experiment with NASA tomato plants. They raised three space tomato plants and three Earth tomato plants in both zoo-doo and potting mix. Students reported that, although the seeds were slower to germinate in the zoo-doo, they were much healthier looking, sturdier, and tastier when mature. They recommend, however, that the strong, rich worm castings be cut half and half with regular potting soil.

The seventh graders opted to market the remaining 35 pounds of the year's zoo-doo. They got a loan from the principal to finance the startup of their business, designed biological containers from recycled white bags, created an advertising campaign, and sold bags of zoo-doo to a local garden center for resale. "The students have become very aware of waste and some ways to recycle," said Sheana, "while honing their math and business skills. They have a firsthand understanding of how recycling in nature works."

(Continued on pg. 11)

Exchange

Grow it Yourself Center

When students at Fiske School in Lexington, MA, finish lunch early, they can choose from a range of vegetable and flower seeds to plant at a special "Grow it Yourself Center" in the hallway. "I set up a plastic tub full of potting soil at one end of the table," says science enrichment consultant, Stephanie Bernstein. "Students can choose from a variety of donated seeds that are organized by type. We have containers and water bottles available, and a poster and film loop featuring plant growth. A parent staffs the table during lunch periods on certain days."

It's been a great success, reports Stephanie. Students help one another plant, "babysit" for one another's seedlings, and bring their interest (and plants!) back to their classrooms. Some students have sold their plants at the school fair; others have planted them in outdoor gardens. Even the ones who inadvertently left their newly planted seedlings in their lockers learned a thing or two about plant needs when the seedlings germinated.

"When seeds get spilled in the process, they are put into a 'mystery seed' bin," reports Stephanie. "The students love to try distinguishing the different mystery seeds and planting some to predict and observe what sprouts."

Celebrating Salad

"Fish guts," as third grade students at Jefferson Elementary in Corvallis, OR, called their fish emulsion fertilizer, at first had quite an odor. But it was all part of raising a fantastic classroom salad. Each group of students was responsible for the care of a different type of plant. "The groups developed their own system for plant care, and even donned such names as Bossa Nova Bush Beans and Peas Please," said parent volunteer, Linda Brewer. And they didn't grow just any run-of-the-mill salad garden—theirs contained such unusual edibles as violets, calendula flowers, coriander, lemon mint, and Oriental greens. "The students were so limited in their ideas about what foods are OK to eat," reported Linda. "If it's not on the supermarket shelf, it's an unknown. This salad project, in addition to being a great interdisciplinary unit, really helped to broaden their food horizons."

Mystery Pollution

The second graders in Lynn Hervey's Peacham, VT, class didn't know what they were using to water the corn in their GrowLab, but it soon became clear that some plants were not doing well. Lynn had collected "mystery solutions" for watering the corn plants—water mixed with motor oil from the floor of a garage, salt water, rain water, and tap water. Students cared for their plants, watered them regularly, but then, said Lynn, "I soon had a rebellion on my hands—it was clear that some of the solutions were harming the students' precious plants. The students were shocked and didn't want to continue. They quickly made a connection to how destructive polluting our environment can be, and the lesson served its purpose."

Earth Day/Mothers' Day "Treelings"

Earth Day and Mothers' Day became a special combined focus last spring for the preschoolers in Wendy Sherman's Sudbury, MA, class. On Earth Day (April 22), students carefully collected small 4-inch oak, white pine, and maple seedlings from the woods and fields around the school. After very gently washing the roots, students were able to examine and compare the different seedlings.

After discussing the importance of trees, reading tree books, and raising questions, each student planted a "treeling," identified with a handmade sign, in a plastic pot. "Tending and observing the treelings until Mothers' Day was a thrill for the kids," said Wendy. "They realized that the treelings, tiny like these youngsters were, with care, will grow larger. We had fun imagining and predicting how they, like the students, would change over time."

The kids took the trees home as a "living gift" for mothers to enjoy for years. After planting, students brought in many pictures of themselves with parents in front of the tree. "It's not just a one-shot mothers' day gift," says Wendy, "These trees will hopefully provide a continuing home science project to care for, observe, and appreciate for years to come."

***Growing Ideas* is published three times a year by the Education Programs Department of the National Gardening Association. *Growing Ideas* provides instructional ideas, horticultural information and a forum for exchange among teachers using classroom gardening to stimulate learning. For a complimentary issue of *Growing Ideas*, write to: *Growing Ideas*, National Gardening Association, 180 Flynn Avenue, Burlington, Vermont 05401. Editor:: Eve Pranis**

Cross-Cultural Harvest

"Some of the schools had beautiful gardens" says Philadelphia GREEN Youth Program Specialist, Eugene Reeves, "but the kids from immigrant families often couldn't relate to the vegetables. That's when I set out to find seeds of vegetables that were more appropriate to the students' own cultures." Eugene has located a range of seeds from around the world, and now school and community gardens in Philadelphia sport such crops as upland rice, Chinese greens, amaranth, pigeon peas, and African squash. "By planting rice in a container of potting mix and setting that in a pot of water, we've even raised some beautiful rice plants right in the GrowLab," boasts Eugene.

Although many of these crops couldn't be grown to maturity indoors, they still served as a nice jumping-off point, and many will be transplanted into outdoor gardens. "Different types of leafy greens are the best to grow to an edible stage in GrowLabs," suggests Eugene.

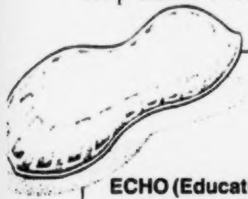
The Puerto Rican children in Iris Brown's Philadelphia gardening program were able to raise cilantro (coriander), rice, and pigeon peas—a crop that is a staple in their culture. "Students and parents alike recognized and appreciated seeing a familiar crop," says Iris. "Those kids who had moved here from Puerto Rico enjoyed sharing their knowledge with those who had been born in this country. The gardens have served as a nice way to maintain cultural identity." By surveying parents and asking local gardeners to share seeds they've brought from their countries, students have increased the diversity of garden crops even more.

In another section of the city, Dr. A. Ahmed reports that "The indoor garden has provided a wonderful context for breaking language barriers, stimulating cooperation, and bringing this ethnically diverse community together." Dr. Ahmed is director of the Educational Advancement Program in Philadelphia which works with students from schools in a primarily immigrant neighborhood.

"The garden has fascinated students, parents, and teachers," he says. "We have 15 varieties of vegetables growing now and plan to find even more crops appropriate to the cultures represented here. When working in the garden, the students cooperate in caring for plants, learn about one another's cultures, and bring that information and exuberance back to their classroom."

Unusual plants from our own country as well as from other countries can be an exciting focus for gardening explorations. A number of teachers, for instance, have reported raising traditionally Southern crops to complement social studies units and/or to tie in with Black history studies. Peanuts, cotton, collards, kale, black-eyed peas, mustard greens are all crops that have been grown (although some are hard to grow to maturity) in GrowLabs. We'd love to hear from anyone who has tried okra indoors!

If you've raised unusual seeds from other cultures or regions, let us know. We'd like to offer planting suggestions and seed sources through *Growing Ideas.*



Sources of Seeds from Near and Far

ECHO (Educational Concerns for Hunger Organization), 17430 Durrance Road, North Fort Myers, FL 33917. This nonprofit organization works to combat Third World hunger by offering seeds of many "underexploited" food plants to people working with Third World farmers. Many of these seeds are also available, for $1.50 per packet, to interested U.S. gardeners. You can write for a free catalog that offers and describes such unusual seeds as: amaranth (one of the major foods of the Aztecs), Italian squash, tepary beans (grown by the Hopi Indians in the Southwest), and pigeon peas (eaten in Puerto Rico).

Pinetree Garden Seeds, New Gloucester, ME 04260. Phone: (207) 926-3400. This company's free catalog has a special section on vegetable favorites from around the world, offering seeds from France, Italy, East Asia, Latin America, and Native Americans. The small packets mostly range from .50 to $1.00 each.

Southern Exposure Seed Exchange, PO Box 158, North Garden, VA 22959. This small company specializes in varieties with special qualities and rich histories. In addition to some of the standard Southern vegetables, they carry the seeds of upland rice (M-101), which Eugene Reeves reported raising in the GrowLab. For a free list of seeds and prices, send an SASE with your request. For a catalog with historical and botanical information, send $3 with your request. (Note: if you identify yourself as a GrowLab teacher and ask to be put on the list for next year's catalog, you'll get a free one in the winter.)

Hastings Seeds, 1036 White St. S.W., PO Box 115535, Atlanta, GA 30310-8535. Send for a free catalog which includes seeds of peanuts, cotton, black-eyed peas, and other traditionally Southern crops.

Green Tips

Transplanting Across the Curriculum

Your students have spent all winter and early spring nurturing their classroom plants. As spring emerges, you may be planning to move your precious seedlings into school or home gardens, school or community flower beds, or other outdoor locations. Consider using transplanting as an opportunity to continue teaching about plants' needs and adaptations, and to tie in subjects across the curriculum.

Planning a Calendar. Your students' first challenge will be to decide when to put different plants outdoors. "Cool weather crops" like broccoli, cauliflower, and cabbage can be set out up to a month before the last danger of frost in your area. "Warm weather crops" like tomatoes, peppers, and melons should be transplanted after all danger of frost is past in your area. Annual flowers and other crops vary—students can check seed packets or gardening catalogs for this information. Some suggestions for student activities follow.

	Number of weeks from seeding to transplant
Broccoli	5–7
Brussels sprouts	5–7
Cabbage	5–7
Cauliflower	5–7
Celery	10–12
Cucumbers	3–4
Eggplant	6–8
Leeks	8–10
Lettuce	3–6
Muskmelon	3–4
Onions	6–8
Parsley	6–8
Peppers	6–8
Squash, summer & winter	3–4
Tomatoes	6–10
Watermelon	3–4

- Find out the average last frost date in your area from local gardeners, the Cooperative Extension service, weather maps, or local weather service.

- Count back to determine, based on seed packet information, when to set each plant out. Then develop a planting calendar.

- Find last frost dates for cities in different parts of the country. Discuss why these dates vary.

- Research and make inferences about how plants' cold tolerance or heat preference relates to where in the world the plant originated.

Hardening Off. Consider how a living thing might respond if moved from a warm, windless, relatively protected classroom to a harsher outdoor environment. To lessen this shock, we suggest "hardening off" seedlings before planting outdoors. A week or so before transplanting seedlings, set them outside for a short period (1 or 2 hours) during the daytime. Do this for longer periods each day. A couple of days before transplanting, leave them out all night as well. This "hardening off" period, during which leaves actually thicken up, will give many types of plants a better chance of surviving the shock of transplanting. Some activities to enrich this process follow.

- Have students imagine and write from a plant's perspective about being moved from a cozy classroom garden to the outdoors. What new challenges might it face?

- Consider conducting an experiment to discover how the health and growth of a "hardened off" plant compares to one directly planted outside and one left indoors.

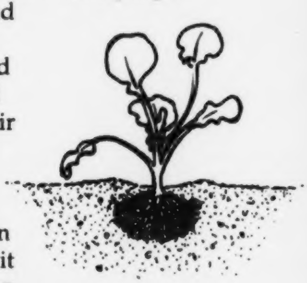
Transplanting. Before transplanting, consider the following activities:

- Conduct part 2 of "Why Root for Roots" in *GrowLab: Activities for Growing Minds* so students can observe how a plant responds when its root hairs are disturbed and broken.

- Conduct "What a Sy-stem" in the GrowLab guide and discuss what role stems play. Then ask students what they can infer about how to treat seedlings when transplanting them.

The best time to transplant seedlings outdoors is on a cloudy or even drizzly day. This slows water loss as leaves continue to transpire (give off water) while the damaged roots cannot take in adequate water. For each transplant, dig a hole a bit larger than the rootball. Mix in compost or rotted manure if available.

Have students carefully remove plants from containers, keeping as much soil around the roots as possible. Remind students to hold seedlings by their seed leaves and not to tug on or bend the stems. Place the plant in the hole and fill it with soil, holding



In-Depth Tomatoes

Although most plants like to be transplanted to the same depth as in their original container, tomatoes are an exception: they actually prefer being planted more deeply. When parts of their stems are buried in soil, small *adventitious* roots will form underground on the stems. Students might want to investigate this by planting some tomato plants deeply, and others at the same level as they were in the pot. Discuss how this adaptation might help plants survive in different environmental conditions.

the plant so it's about the same depth as in the container. Water seedlings well after transplanting. Often after transplanting, seeldings look droopy or wilted since damaged roots have limited ability to take in water. In a few days, you should notice them perking up.

- Use math skills to measure the distance between seedlings (based on seed packet or catalogs), and the arrangement of seedlings in a bed. Consider using a body part such as a hand span to measure distances.

- Water some seedlings before transplanting, and leave others dry. Have students observe and compare the amount of soil that sticks to the roots. What do the observations indicate about the role of roots, water, and soil?

- After transplanting, water some seedlings with a dilute manure tea, seaweed, or other fertilizer. Compare their growth to others given only water. Note: If too strong a solution of fertilizer is used at this stage, it could hurt tender roots.

- Students may want to plant some out on a sunny day, and others on a cloudy day, to compare how plants adjust to transplanting. Based on students' understanding of plant structures and needs, discuss why plants may respond better on a cloudy day.

- Sturdy, healthy plants are best able to survive the shock of transplanting. Challenge students to describe any analogies this has for humans.

Assessment: Green Thumbs Up

Watching a seedling unfurl, witnessing a neglected plant respond to care—these experiences set the stage for exploration, discovery, and learning. But just what *do* students gain from their growing experiences? As educators, we're increasingly pressured for results. Your responses to our *Growing Ideas* newsletter survey reveal that your classroom gardening efforts are enriching content learning, science and problem-solving skills, and attitudes and behavior. These are the types of changes you consistently reported:

- IMPROVED USE OF SCIENCE SKILLS (observation, data collection, communication, and setting up experiments were frequently mentioned)
- INCREASED UNDERSTANDING OF SPECIFIC CONCEPTS (plant needs, structure, photosynthesis, etc.)
- INCREASED ENTHUSIASM, EXCITEMENT, INTEREST IN SCIENCE, PLANTS, AND LEARNING
- IMPROVED CLASSROOM COOPERATION AND OVERALL BEHAVIOR
- INCREASE IN CARETAKING AND NURTURING BEHAVIOR
- INCREASED PRIDE, SENSE OF ACCOMPLISHMENT, SELF ESTEEM, CONFIDENCE
- INCREASED RESPONSIBILITY
- IMPROVED ENVIRONMENTAL AWARENESS AND CONCERN

We've been struck by the volume of feedback on changes in behaviors, "affective" areas. Many of you report that students with learning deficits, emotional challenges, or serious behavioral difficulties became engaged and positively affected by their growing experiences. Your comments paint a strong image of some of the less "measurable" impacts of using plants and gardens as instructional tools.

> ***"Several newcomers dramatically changed from ruffians to gentle caretakers...They're so excited about growth and extremely curious to explore and find out answers to their own questions... They exhibit such gentleness and respect for plants, and it's translated into a broader concern for the environment."***

Please continue to share with us how plant- and garden-based explorations seem to affect students' attitudes and behaviors. What indicators tell you that these might be long-lasting changes? What types of feedback have you received from parents? How have these changes carried over into other areas?

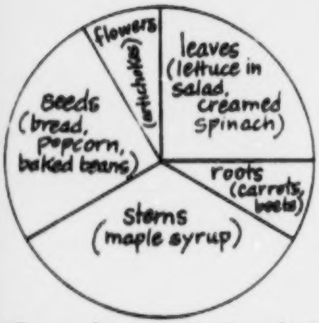
GrowLab Students Excel in National Evaluation

During 1990/91, we had teachers in 57 third grade and 30 fifth grade classrooms across the country administer paper and pencil tests of students' understanding of life science concepts and science process skills. Half of the classrooms were actively using the GrowLab program and curriculum and the other half (control classrooms) were using other instructional programs to teach life science. The preliminary analysis from our third grade classrooms reveals that students in the GrowLab classrooms scored significantly higher in conceptual and science skill understanding than students in non-GrowLab classrooms.

These results are exciting, but we also recognize the limitations of paper-and-pencil-type tests for accurately measuring what students really gain from hands-on, inquiry-based learning. In the last issue of *Growing Ideas*, we shared some of your methods of assessing your students' progress. Please continue to use the newsletter survey to let us know how you're assessing students, and we'll continue to share ideas from other educators.

Radishes, Roots,

"My students had always disliked math," reported a fourth grade teacher from Hartford, CT, "but when we started a classroom garden, they eagerly figured out how many hours to leave our lights on, measured and graphed growth rates, and predicted when their vegetables would be mature. Their excitement about growing things helped their math skills soar."

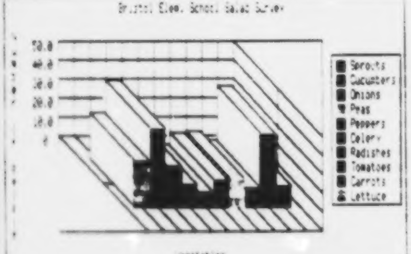


Percentage of Plant Parts Eaten in One Day

Salad Survey

Pat Pierce's Bristol, VT fourth and fifth graders became immersed in math when they decided to conduct a "salad survey," suggested in *GrowLab: Activities for Growing Minds*, to determine the salad ingredient likes and dislikes of their families and fellow students. Groups first brainstormed a wide range of salad ingredients and the class settled on ten for the survey.

"They really had to think things through at each step," said Pat. "Each group was then challenged to develop a graph to represent their findings. They translated their graphs to computers, calculated the percentage of respondents favoring each vegetable, and described the whole project on wall charts."



Solving Problems

- Determine how many seeds per row or container will be needed if a packet says to plant x seeds every x centimeters.
- If you have x plants, what are several ways you can group them when transplanting them outdoors (e.g., 4 rows of 4 each or 2 rows of 8 each)?
- To determine if old seeds are still healthy, try germinating 10 on a moist paper towel placed in a plastic bag. Figure out the percentage germinated, and determine whether they're worth planting in the garden!
- Estimate and verify the number of seeds in a fruit. Predict how many fruits you'd have if they all germinated and each plant produced x more fruits. Discuss what prevents this from happening in nature.
- Given the recommended dose of your fertilizer and your average rate of watering, calculate how much fertilizer you'd need for a week, a month, or a year of indoor garden
- Figure out the fraction or percentage of seeds that actually sprout of those planted in a given container.
- Try some root growth rate problems. For instance, roots of young seedlings can grow at .2mm per hour. At that rate, how long would it take a carrot root to reach the bottom of a 10-cm pot? Discuss and investigate whether plant parts grow at the same rate throughout their lives.
- Dig up a set volume of soil from outdoors. Count the number of earthworms, and estimate the total number of worms in an area.

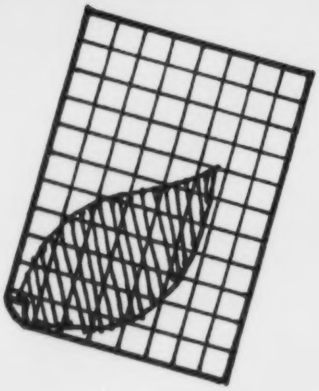
- Identify plant parts in different foods, using school lunches as a springboard (e.g., bread from seeds, pizza sauce from fruit, etc.). Calculate and graph the percentages of different plant parts represented in a typical school lunch.
- Determine when to start seedlings indoors for spring plantings based on the days to maturity and recommended dates for transplanting out in your area.
- Challenge teams of students to grow the biggest...longest...heaviest of a particular vegetable. Keep daily records, develop criteria for determining winners, graph results, and conclude with a feast!

Identifying Patterns

- Investigate mathematical patterns in nature. For example, is there a relationship between number of flower petals to number of stamens and pistils? Is there a relationship between the size of a fruit and the size or number of seeds?
- Make leaf rubbings with crayons.Identify and classify different leaf vein patterns.

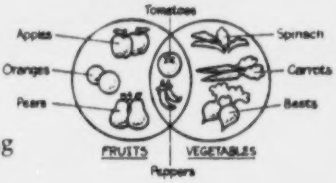
and ‘Rithmetic

Like language, math is integral to the science process--opportunities flourish for tying in and reinforcing math concepts with your classroom growing experiences. From basic measurement, sorting, and classification to more elaborate problems, surveys, and recordkeeping, plants motivate and provide a context for student interest.



Sorting/Classifying

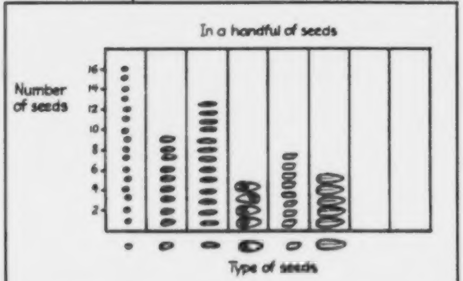
- Have students sort and classify leaves into different types, then calculate the percentage of the collection each category represents.
- Predict, then count, compare, and graph the number of seeds inside different fruits.
- Draw Venn diagrams, showing intersecting sets, to categorize fruits and vegetables. One set should show fruits; the other, vegetables. The intersection should show those fruits we commonly consider vegetables.



- Sort a small amount of birdseed; glue seeds on paper to make a graph showing the numbers of different types of seeds in the mixture.

Measuring/Graphing/Mapping

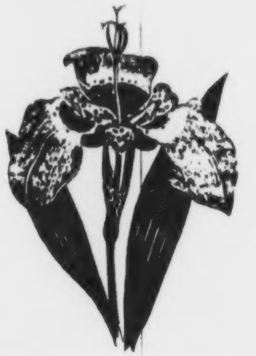
- Draw a map, to scale, of your GrowLab indoor or outdoor garden.
- Measure and compare areas, lengths, and circumferences of different plant parts under different growing conditions.
- Compare and graph growth rates of a fast-growing plant (e.g., beans) with a slow-growing plant (e.g., carrot).
- With a waterproof marker, draw rings on the stem of a bulb, bean, or other straight plant stem at 1-cm intervals. Measure and graph the distrance between the rings daily for one to two weeks to see how stems grow. Consider exploring whether this growth changes as light and temperature change.
- Determine the volume of soil mix necessary for x pots.
- Grow sprouts for a salad. Measure a certain volume, estimate the number of seeds, measure the change in volume that the sprouts occupy daily. Note changes in weight over time.
- Estimate the weight of each ingredient in your classroom salad garden, then weigh and graph the percentage of the total that each ingredient occupies.
- Calculate and graph the rate at which colored water flows up different stems (See "What A Sy-Stem," page 70 in *GrowLab: Activities for Growing Minds*).
- Compare different plant roots by measuring and trying to estimate the total root length.
- Use string to measure the lengths and circumferences of non-straight roots, fruits, leaves and other plant parts.
- Calculate and compare the surface area of different leaves by drawing outlines on graph paper.



Plant-Related Businesses

Earning money with plants has been a math motivator for students in a number of gardening classrooms who have sold everything from houseplants and seedlings to sprouts to worm castings (dubbed "zoo-doo"). A range of math skills are required—from developing a plan, projecting costs and sales, to actually selling, making change, and reporting on profits or losses. Lou Meyers's high school students' plant business actually "incorporated," allowing students to purchase stock for 25 cents a share. Syndee Malek in Michigan reported that her fifth graders had their eyes opened to the harsh realities of business after dreaming about profits from their plant sale. It seems that students had not at first recognized that they would have expenses to deduct from their profits!

Garden Business Partnerships Bloom



"There are so few young people interested in going into horticulture today," said Forest Lake Greenhouses owner Lisa King. "Our industry needs good employees...and the future of the world rests on young people understanding the natural world." When nearby Savannah Grove (South Carolina) Elementary School scheduled a summer science camp, Lisa and her husband Tim were invited to share their knowledge and love of plants with fifth graders.

Lisa and Tim worked side by side with fifth graders on propagation projects and fertilizer explorations, and invited classes to the greenhouse for tours. When students returned to classrooms, participating teachers reported that their interest in plants remained high. "The kids were so excited about what they learned that they shared their experiences with parents," Lisa said, "and many brought parents into the greenhouse."

Some nurseries or garden centers offer discounts to teachers doing classroom gardening programs. Others donate products (seeds toward the end of the gardening season are a good bet). While not all garden centers are inclined to offer discounts or donations, they may support classroom gardening in other ways. One nursery business agreed to grow students' second-generation space seeds in its greenhouse when the school GrowLab was filled to the brim with a salad project.

Plant of the Week

A "plant of the week" project in the Lexington, MA, elementary school was made possible by a partnership with a local plant business. Science consultant Stephanie Bernstein reported that a local florist agreed to loan a different plant each week with the understanding that the plant would be returned in good condition.

Each Monday morning, a parent volunteer put the plant of the week on display (with a sign thanking the nursery) on a table in the main school hallway. A sign highlighting the plant name, country of origin, care requirements, and other interesting information was placed next to each plant.

Mini-oranges, pocketbook plants, and other delights brightened the hall throughout the year. Said Stephanie, "The students and teachers eagerly anticipated the new plant each week. I would leave one leaf aside that students could handle and more closely observe. Back in the classrooms, students had questions that lead to further explorations and activities—like raising their own 'garbage gardens' from lunch fruit seeds, for example." At the end of the year, the students sent a big thank-you card which bolstered the florist's interest in helping again the following year.

Tips for Approaching Businesses

Some plant-related business owners may immediately see the value of donating resources or time to classroom gardening projects, and others might be supportive with a little nudging. Consider these suggestions when asking business owners to support your growing efforts:

- Describe (better yet—have your students describe) your growing project. Let them know specifically what types of materials (potting mix, seeds, containers, etc.) you will need.

- Highlight what you think your students will gain from integrating plants with classroom learning. Remind business owners that their support will help cultivate the gardeners, consumers, and decision-makers of the twenty-first century.

- Invite the business owners to your school to lead an activity or presentation, help brainstorm growing projects, attend a salad party, or conduct a workshop for teachers.

- Let them know their support will be recognized to parents, other teachers, and the public through letters home, signs in the classroom, and newspaper articles or other public relations efforts.

- If you do receive support from a garden-related business, make sure to thank them personally and publically. Original student thank-yous can go a long way toward ensuring continued and enhanced support.

****

Help *Growing Ideas* Continue to Bloom

Thanks to a grant from the National Science Foundation, we have offered six free issues of *Growing Ideas* to educators using plants and gardens to help young minds grow. Although this funding for the newsletter is concluding shortly, we're determined to keep this valuable resource and interactive network alive and available to interested educators.

As we search for corporate and foundation support for *Growing Ideas*, we also welcome your donations, of any size. With your support, *Growing Ideas* can continue to inspire activities across the curriculum, highlight effective teaching strategies, and spark exchanges between growing classrooms. Send your tax-deductible contributions to: National Gardening Association, *Growing Ideas*, 180 Flynn Avenue, Burlington, VT 05401.

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KEEP OUR NETWORK GROWING!

☑Survey

We're pleased to have you as a member of the growing national network of educators using classroom gardening to stimulate learning. Sharing your classroom gardening experiences can help make the network a useful resource for teachers nationwide, and will help us develop partnerships and resources to meet your instructional needs.

Please take a few minutes to complete this survey to inform or update us on your efforts. Let us know whether you'd like to begin or continue receiving **free issues of *Growing Ideas*,** and return the form to: **Editor, *Growing Ideas*, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.**

☐ **If you are not a classroom teacher, but a "partner" working with educators, please check this box and fill in what's appropriate on the survey. We'd like to call to find out more about your efforts.**

Name ______________________ Title ______________ Grade ________

School/Organization ______________ Street ______________________

City ________________ State ____ Zip ________ Phone ____________

☐ Please begin/continue my free subscription to *Growing Ideas.*

☐ Please send me information on your curriculum resource books, GrowLab Indoor Gardens, videos, posters and other resources. (You will automatically receive this if you'reon our mailing list and receiving this newsletter.)

1. Which type of growing setup are you using in your classroom?

☐ GrowLab (prefabricated)
☐ Other commercial indoor light unit
☐ Windowsills
☐ Other ______________
☐ GrowLab (homemade from our plans)
☐ Other light unit (made from your plans)
☐ Greenhouse
☐ Outdoor garden

2. With how many students per year are you gardening indoors? ______ students per year.

3. If applicable, in what year did you start using GrowLab Program resources and/or equipment? __________

4. Which, if any, GrowLab Program resources have you used?

☐ *GrowLab: A Complete Guide to Gardening in the Classroom*
☐ *GrowLab: Activities for Growing Minds*
☐ *Growing Ideas* newsletter
☐ GrowLab training (by National Gardening)
☐ Introductory video, "A Growing Experience"
☐ Teacher resource videos
☐ GrowLab training by ______________

5. From where did you get funds or donations for your indoor gardening equipment and supplies?

☐ school budget
☐ district or state grant
☐ local business
☐ chapter 2 funds
☐ PTO
☐ horticultural organization (club)
☐ corporate grant or donation from: ______________
☐ other (describe below)

6. Briefly describe some of the activities that have been highlights of your classroom indoor gardening experience.

7. Describe ways in which your classroom gardening efforts have benefitted from outside support or "partners" (e.g., volunteers, material donations, funding).

8. What are some tools with which you assess what your students have gained from their growing experiences? Please describe some significant gains.

Our Growing Ideas Classroom Exchange is a forum for gardening classrooms to share information. If you'd like to be included in our Exchange pamphlet, list what your class would like to exchange with other gardening classrooms.

☐ pen pals
☐ specific experimental data
☐ classroom videos
☐ seeds (from local plants, special seeds, "space" seeds, etc.)
☐ classroom-produced videos
☐ other (please describe below)

11. Have you given GrowLab presentations or workshops for other teachers? (Please describe.) Would you like to?

12. How did you hear about our GrowLab Indoor Gardening Program?

☐ state or national educators' convention (which one?) ____________________
☐ mail brochure
☐ other teachers, curriculum coordinator, or science supervisor
☐ advertisement in ____________________
☐ article in ____________________
☐ other ____________________

13. Please list names and school addresses of other teachers who might like to receive information on plant- and garden-based educational resources (attach another sheet, if necessary.)

(Continued from pg. 1)

Getting Started with Worms

Inspired? You don't have to take on such an elaborate project to use worms as a learning tool. Some resources are listed below.

- *GrowLab: Activities for Growing Minds* by the National Gardening Association, 1990 (see below). The activity, "Getting Hooked on Worms" offers background information, suggestions for setting up a small, inexpensive classroom worm farm, and activity ideas for exploring these fascinating creatures and their relationship with plants.
- *Worms Eat Our Garbage: Classroom Activities for a Better Environment* by Mary Appelhof, Mary Frances Fenton, and Barbara Harris. Flower Press, 1992. Activities in this newly released 126-page book for fourth through sixth grade students use worms and the environment to develop language, math, problem-solving, and critical-thinking skills. It also contains teacher's guidelines and an index. To order a copy send $12.95 plus $2.00 shipping to: Flower Press, 10332 Shaver Rd., Kalamazoo, MI 49002.

The same company also carries red wigglers ($19/pound), complete Worm-a-way™ worm composting systems, and *Worms Eat My Garbage* (a resource book for setting up and maintaining a worm composting system.) Write for details and ordering information.

- *Earthworms, Dirt, and Rotten Leaves: An Exploration in Ecology* by Molly McLaughlin. Atheneum Press, 1986. This book offers an introduction to ecology, with a focus on worms. It encourages observations and experiments, and highlights the role of earthworms in the food chain and in soil improvement.

Resources

Hydroponics Sources

After reading "What, No Soil?" from our Spring, 1991 issue, several teachers asked for sources of rockwool™, fertilizer, and other hydroponic (soilless) growing supplies. Two mail order companies promoting classroom hydroponics are listed below. Write for free catalogs.

Great Bulbs of Fire
RD 2, Box 815
New Freedom, PA 17349

Suncor Systems, Inc.
PO Box 11116
Portland, OR 97211

Special Offer for *Growing Ideas* Readers:
Order two teacher's resource books and choose a free classroom poster

GrowLab: A Complete Guide to Gardening in the Classroom (Horticultural guide)
This 128-page guide has instructions for raising vegetables, flowers, and herbs indoors. It includes sample projects, an annotated resource section, and complete plans for a build-it-yourself wooden GrowLab.

GrowLab: Activities for Growing Minds (Curriculum guide)
This 307-page K-8 curriculum guide, funded by the National Science Foundation, was written and classroom-tested by educators. It includes creative activities for hands-on, inquiry-based science lessons, reproducible student recording sheets, and suggestions for extending lessons through the curriculum.

Instructional Classroom Posters
Our four colorful classroom posters have lively illustrations, compelling information, and challenges to engage students in hands-on, minds-on explorations.

QTY.		EACH	TOTAL
	GrowLab: Activities for Growing Minds	$19.95	
	GrowLab: A Complete Guide to Gardening in the Classroom	$14.95	
	Classroom Posters **(1 free with purchase of any 2 books)**		
	Salad Celebration poster	$ 6.00	
	Sensational Seeds poster	$ 6.00	
	Those Amazing Plant Parts poster	$ 6.00	
	Plant a Question, Watch It Grow poster	$ 6.00	
	Classroom Poster Series (the above 4 for the price of 3)	$18.00	
		Subtotal	
	(Shipping: under $30, add $3, over $30, add 10%)	Shipping	
		Total	

☐ Check or money order enclosed ☐ Charge to: ☐ MasterCard ☐ Visa

Card Number ____________ Exp. Date ______ Signature ____________

Address (if different than address label on the other side):

Name ____________ School/Organization ____________

Street ____________ City ____________

State ______ Zip ____________ Telephone ____________

Resources

Free Grass Activity Guide

Grass. The word may evoke images of expansive green lawns, but would you eat some for breakfast? You bet! Rice, wheat, corn, oats, and sugarcane are all grasses that humans worldwide depend on for survival.

From the tundra to the tropics, grasses are adapted to a wide range of conditions. And while their simple leaves absorb CO2 and release oxygen, their extensive spreading roots hang onto precious topsoil. (The tiny roots of one grass plant, under ideal conditions, if laid end to end, can stretch 387 miles!)

The National Gardening Association has joined with The O.M. Scott & Sons Company to develop a thematic 8-page activity guide on this fascinating plant family for K-8 teachers. The guide contains background information and hands-on, minds-on interdisciplinary activities for growing and exploring grasses in the classroom.

If you already receive *Growing Ideas*, you will be sent a copy of this grass activity guide in April. If you are not yet a *Growing Ideas* recipient, but would like a copy of the activity guide, write to: **Dave Slaybaugh, Creative Services, The O.M. Scott & Sons Co., 14111 Scottslawn Rd., Marysville, OH 43041.**

Classroom Exchange

When Howard Scher's New York City junior high students sent second generation NASA tomato seeds to a classroom in Louisiana, they received, in exchange, Louisiana-grown rice, beans, and grits which became new taste experiences. Via letters, students decided to grow the tomato seeds in both settings and compare results.

"In addition to the fun of writing to and exchanging data with other students," said Howard, "they've gained a better understanding of other areas and people."

Howard is seeking other third and fourth grade gardening classrooms across the country to telecommunicate through a special bulletin board with his third and fourth graders. He has offered to help interested classes with computers get onto the bulletin board. **Contact Howard at: P.S. 75, 735 West End Avenue, New York, NY 10025.**

Join the Exchange

More than 100 classrooms, wanting to share everything from native seeds to videos to experimental data, are described in our Growing Ideas Exchange list. For a copy of the list, send a self-addressed envelope with .52 postage to: Classroom Exchange, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.

Growing Ideas

National Gardening Association
180 Flynn Avenue
Burlington, Vermont 05401

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ASSOCIATION

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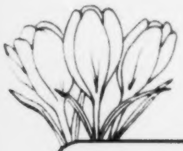
A JOURNAL OF GARDEN-BASED LEARNING

Growing Ideas

Published by the National Gardening Association

Volume 3, Number 3, September 1992

Turn on Learning with Bulbs



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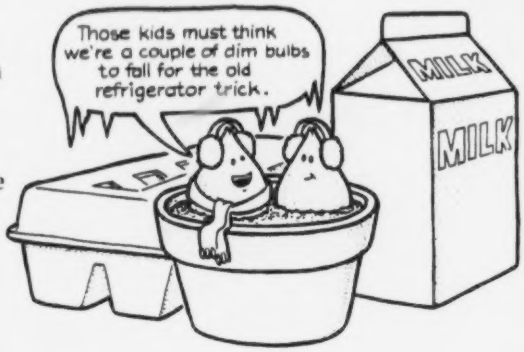
GrowLab Presentations

If you have given any GrowLab awareness presentations, in-service workshops, or courses, or if you wish to do so, contact the Education Department at NGA for brochures, newsletters, and training suggestions. We would particularly like to assist with GrowLab presentations at state and regional educators' conventions.

This project was supported, in part,
by the
National Science Foundation
Opinions expressed are those of the authors
and not necessarily those of the Foundation

"A bulb is a promise," Wendy Sherman tells her pre-schoolers in Sudbury, MA. "You can do your part to provide certain basic conditions for them, and then you have to hope that nature comes through with the rest." These marvelous packages, each containing a complete miniature plant and its lunch, can provide a captivating theme for exploring plant growth and adaptations, using math skills, and enriching history, while brightening winter classrooms with the promise of spring.


Those kids must think we're a couple of dim bulbs to fall for the old refrigerator trick.
MILK
MILK

"Would it really matter if we planted a bulb upside-down?" asked several of Wendy's preschoolers. With Wendy's encouragement, the class decided to find out. The kids planted one crocus right side up and one upside-down, then chilled them through the winter. "Students made a whole range of predictions about what would happen," said Wendy. While one bulb grew as they'd expected, they dug up the "upside-down" bulb to discover it had grown circuitously in an attempt to reach light, but never bloomed. "Students concluded that it must have used up its energy on its trip to find light, but had none left for flowering," Wendy said. "Seeing that dramatic visual image gave kids an understanding and appreciation for the amount of energy stored in bulbs."

Meanwhile, in other GrowLab classrooms throughout the country, a range of bulb projects have taken root.

❖ Math teacher Michael Bowers and science teacher Jerry Parker were searching for a theme for an integrated math/science project for "at risk" 10th through 12th graders in Eugene, OR. A going-out-of-businesss sale at a local nursery provided the inspiration and dozens of low-cost bulbs for this hands-on project. Teams of students planted tulip bulbs in containers in October with hopes of coaxing them to bloom for Valentine's Day.

The pots were buried under a stack of leaves outdoors to provide them with a "winter," then brought back to the classroom for forcing during January.

(continued on pg. 6)

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Exchange

Global Gardening

It wasn't a guacamole fetish that inspired Arlene Marturano's Columbia, SC, 7th grade geography class to plant a GrowLab avocado plantation. Their study of rainforest deforestation and their comparisons of monocultures and diverse forests sparked the idea. A local Mexican restaurant supplied abundant avocado pits, and the avocado plantation became a simulated monoculture backdrop for their forest studies. Imagine what parents received that year for holiday gifts!

"I had initially gotten a grant as an elementary environmental education teacher to develop a Global Gardening unit," said Arlene. "When I was suddenly transferred instead to teach middle school geography, I thought about how to tie GrowLab gardening in with geography. The connections were endless!"

The avocado plantation was only the beginning. Arlene's class also raised honey locust trees in the GrowLab as they studied current world forest issues. With help from an orchid specialist, they grew a range of orchids and identified their native countries. Through a "rooting friends" project, they exchanged information about native plants and foods with a peace corps volunteer from Malawi and with student pen pals around the globe.

As a long-term geography project, each student researched the native plants and foods of a particular country. This dovetailed nicely with the class GrowLab Victory Garden, raised to complement World War II studies. "The Victory Garden," said Arlene, "soon sported plants native to the countries students were researching—zinnias, marigolds, and portulacas from Mexico; savory, oregano, chervil from France; pumpkins from South America. Our herb growing success and a spice company's educational kit sparked a project that included creating spice-scented world maps, and mapping the origins and trade routes of herbs and spices.*

"When I first suggested to these 7th grade geography classes that we might explore geography via plants, they thought it was a crazy idea," said Arlene. "But as they got involved with the planting projects, they were excited to see things grow, and soon started to make the connections."

*** For information on McCormick & Company's "Spice Connection Geography Kit," call 800-632-5847.**

Pondering Pond Water

Inspired by the "Biosphere in a Bottle" feature in the September 1991 issue of *Growing Ideas*, Kathleen King's 7th and 8th grade special education class in Gurnee, IL, designed a biosphere experiment that won second place in the school's science fair. "Were they proud," said Kathleen. "These students had never used science process skills to conduct a real experiment. With some guidance, they progressed through the steps

(continued, next page)

Thanks to Stokes and Breck's

Many thanks to Stokes Seeds and Breck's Bulbs for underwriting this issue of *Growing Ideas.*

Breck's Bulbs, the leading importer of Dutch flower bulbs, has served America's gardeners since 1818. To help spark learning with bulbs, they are offering special classroom bulb collections free *to Growing Ideas* readers (see page 12.)

Stokes Seeds, for 112 years, has been a forerunner in the seed industry. During the past two years, Stokes has awarded GrowLabs to five schools through a GrowLab Grants program. Last year, they helped support our popular Salad Celebration poster.

We appreciate both companies for funding this issue of *Growing Ideas* and for their continued efforts to help young minds grow.

Growing Ideas is published three times a year by the Education Programs Department of the National Gardening Association. _Growing Ideas_ provides instructional ideas, horticultural information and a forum for exchange among teachers using classroom gardening to stimulate learning. For a complimentary issue of _Growing Ideas_, write to: _Growing Ideas_, National Gardening Association, 180 Flynn Avenue, Burlington, Vermont 05401.
Editor: Eve Pranis
Contributor: Diane Eliott-Weaver

(continued from page 2)

and learned a lot in the process."

Students set up four jars with water from a local creek, then gathered and recorded baseline information on the color, smell, and appearance of living organisms. After discussing the types of materials that could run off into a creek, they chose to simulate pollution from fertilizer, salt, and insectides. Students observed interesting shifts and changes in the jars, some supporting and others conflicting with their predictions. After six weeks of observing and charting changes, students wrote up results, thoughts, and questions on the word processor.

"They remembered and referred to the experiment all year," said Kathleen, "when we had news and discussions about the environment, chemical pollution, etc.—it all became very real because of the classroom simulation."

For a copy of the "Biosphere in a Bottle" activity, send an S.A.S.E. to *Growing Ideas* Editor, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.

Corn Capers

During a unit on rainforests, Pat Murray's 2nd graders in Westerville, OH, wondered about what happens when forests are cut for farming, and the same food crops are grown on poor soil year after year. Their questions inspired an activity idea for their classroom GrowLab. Why not set up a classroom experiment to see what would happen if one crop was planted and harvested over and over again on the same plot of soil?

Using 3-inch by 8-inch containers with drainage holes, students planted 10 corn seeds in simulated rainforest soil—poor soil covered with a thin layer of topsoil. They made five consecutive plantings and then, as a class, brainstormed how they would observe the plants' growth: 1. by measuring the time it took the seeds to germinate; 2. by measuring the time it took them to grow to five inches; 3. by observing the quality of the leaves; and 4. by measuring how many actually germinated and grew. Students cared for, harvested, recorded observations, measured and graphed results.

Once the seedlings reached 5 inches, they were plucked from the ground and new corn seeds planted immediately. "Just as the students had predicted, based on our readings," said Pat, "the number and quality of seeds that grew significantly diminished each time we replanted them."

"Although this was a loose simulation," she added, "the impact of doing and seeing it firsthand helped the kids understand the significance of 'overfarming' an area. It sparked a class discussion about how our simulation differed from real life, and about the lack of choices people in those areas may have."

A Little Bonsai

Although trying bonsai in the classroom might seem like a way to teach patience, agriculture teacher Lisa Acampora of Canton, PA, found it to be an exciting and rewarding experience for her high school students.

"Students not only learned concepts relating to plant growth, soils, basic needs, etc., but they also developed a new appreciation for plants as art and as living organisms," reported Lisa.

Although bonsai starter plants are sometimes available in local plant stores, Lisa recommends purchasing small juniper bushes from a nursery. They used 1-foot tall junipers with a 12-inch root ball. "Junipers have plenty of branches to work with," said Lisa, "and are very hardy and forgiving."

To prepare for their own hands-on project, students first researched and learned about the cultural aspects and history of bonsai. "Then before pruning or wiring any branches," said Lisa, "students considered their design, then used pipe cleaners to illustrate how they would prune, and made predictions about how their mini-trees would develop. I emphasized that, like the true bonsai masters, their creations would be unique expressions of themselves."

A few young entrepreneurs learned marketing concepts as they negotiated selling their classroom-produced bonsai trees to a local merchant who resold them to the public. "Most, however," said Lisa, "chose to hang on to and continue to care for their precious creations. The students gained confidence at completing a challenging task. They worked together well, and learned a bit more about each other as they conferred and asked for different opinions on their creations. This type of project would be a great addition to any classroom gardening program."

For a packet of handouts, resource lists, and curriculum ideas on bonsai, send $14 with your request (includes shipping and handling) to: Lisa Acampora, RD 2, Box 139, Canton, PA 17724.

How Are Young Minds Growing?

In the last issue of *Growing Ideas*, we reported briefly on what GrowLab teachers and our formal national evaluation reveal about what students are gaining from their GrowLab experiences. While our evaluation results reveal that GrowLab students are indeed learning important concepts and developing positive attitudes toward themselves, science, and the environment, your comments and anecdotes convey the strongest image of how GrowLab helps young minds grow. Read on....

Highlights from Your Colleagues

"Many students in my class had behavioral problems. It's been amazing to see even the toughest, most careless ones become responsible caretakers and nurturers. They cooperate better, care more about living things, and have become less selfish...Even parents have commented on the behavior changes."

"They have absolute enthusiasm for their plant explorations—from planting to checking growth to measuring. They have a zest for science, questioning, and initiating new projects that I haven 't seen before."

"Self-esteem and pride have greatly increased...Their successful growing experiences and knowledge that they can design their own experiments and find answers have boosted their sense of self worth."

"They've really learned in context about plant structures, adaptations, life cycles, basic needs. This shows up in discussions, journal entries, and test scores."

"Their observation and problem-solving skills have vastly improved, along with their ability to create and interpret graphs. "

"They've gained an understanding of and appreciation for the role of plants and our interdependence, and have a greater appreciation of the need to protect the environment."

"I've been impressed by how my kids were anxious to work hard at reading so they could read seed packets and instructions. Their writing quality and confidence have improved as they've kept detailed journals and records on their garden and plant investigations."

Cultivating Keen Observers

"They look at and observe things so much more carefully now," reported 5th grade teacher Sharon Wheeler from Westerville, OH. When Sharon's students started keeping GrowLab journals, she said, their observations and drawings were very general--for example, *the bean plants had six leaves*.

Fascinated by their growing plants and challenged by Sharon's inquiries, students began attending more carefully to details, describing more subtle changes, comparing their plants with others, and asking questions about what might cause the differences. "The questions triggered by their more in-depth observations have inspired further investigations, both indoors and out," said Sharon.

"Of course, developing these skills and really understanding concepts is a long-term process," she added. "For instance, the students enjoyed the limited resource crowding activity in "Make Room for Raddy" from *GrowLab: Activities for Growing Minds*. But they clearly couldn't apply what they learned about overcrowding immediately. It wasn't until, several weeks into the hands-on exploration, students observed that some kids had bigger and healthier radishes that they began to understand the need for thinning. These types of long-term activities can really help kids construct their own understanding of the world around them."

Encouraging Exploration

"I wanted my 7th-12th grade special education students to actively use the scientific method," said teacher Glen Westbroek from Provo, UT. "We had previously run through the different processes and steps for controlled experiments—and about 50% of the students could recite back what they'd learned on a pre-test."

Almost accidentally, the students had the opportunity to apply these skills. Glen reported that they had been raising polka dot plants indoors. Some plant pots were in a tub receiving continuous water, while, due to space limitations, other pots had been left outside the tubs.

"Before long," said Glen, "students began to notice differences in the growth of the plants under the two conditions, and began to wonder about and question why they grew differently." Glen tried to serve as a guide and learning resource, helping pairs of students think through and design their own experiments to test the effects of different moisture regimens.

"The back and forth between the pairs of students seemed important for constructing understanding," said Glen. "Some were initially frustrated because they had different ideas, but by actively experimenting and trying one another's ideas, they developed a better understanding." Glen reports that after the polka dot plant explorations, 90% of the students could correctly identify and apply the same science skills on a post-test.

"Not only did their understanding and use of science skills improve through this exploration," reported Glen, "but behaviors really changed positively as they worked together to solve problems and successfully raise something living."

How Do *You* Help Young Minds Grow?

We want to learn more about the techniques and strategies that you find effective to help students get the most from their growing experiences, so we can help other educators. How do you encourage and guide student investigations? What types of questioning do you find stimulate thinking and problem-solving skills? Which activities from *GrowLab: Activities for Growing Minds* have been most useful? How do you incorporate group or cooperative learning techniques into your plant investigations? How do you help students link what's learned in the GrowLab to broader concepts and experiences? How have you incorporated other subject areas into your growing activities?

We'd like to publish highlights from your responses in future issues of *Growing Ideas*. Please use the enclosed survey form to elaborate on the questions above. If you would find it easier to give your feedback via a phone call, indicate that on the survey and we'll try to call you at a convenient time.

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Join the Growing Exchange

Last spring, 6th graders in New York City enthusiastically shared garden videos and letters with students from a school in rural Ohio. "The kids loved comparing activities, successes, and failures from their respective classroom gardens," reported their teacher, Elba Iris Marrero. "They also enjoyed discovering similarities and differences in lifestyles, neighborhoods, and cultures."

More than 200 classrooms, wanting to share everything from native seeds to videos to experimental data with other gardening classrooms, are described in our *Growing Ideas* Exchange list. If you'd like to be included on the list, indicate so when you return the enclosed survey. For a copy of the list, send a self-addressed envelope with .52 postage to: **Classroom Exchange, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.**

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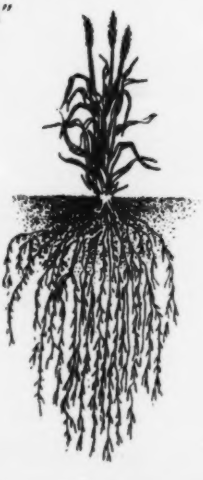
Just watching a seedling unfurl or beloved plants blossom and bear fruit can inspire questions, observations, and student explorations. Lessons in *GrowLab: Activities for Growing Minds* help you take that further and focus on specific science concepts, science process skills, and attitudes toward science and the environment. The following, for instance, are a few examples of *GrowLab: Activities for Growing Minds* activities that help sharpen observation skills.



***Activities for Growing Minds* Lesson**	**Activities for Building Observation Skills**
"Journey to the Center of a Seed"	• sorting, Bingo Seedso, seed memory game
"Why Root for Roots?"	• observing, comparing, and describing roots
"Look Out for Leaves"	• Leaf Me Alone observation game
"Soil Sort"	• soil dissection
"Plant Cycles"	• life cycle scavenger hunt
"Flowers Up Close"	• several observation games
"Fruit for Thought"	• fruit sorting Line Up game
"Plant Private Eyes"	• describing mystery plants game
"Diverseedy"	• seed sorting and planting exploration
"Lettuce Be Different"	• Lettuce Be Different game/growing activity
"Turning Over a New Leaf"	• Leaf hunt and adaptations activity

(continued from pg. 1)

Students kept a daily bulb diary and plotted growth. They decorated the pots with foil wrap and ribbons and brought 40 pots of vibrant tulips as Valentine's Day gifts to a local nursing home. "The kids had never done much with plants," commented Michael, "and they really enjoyed this project. It inspired a lot of interest in gardening, as well as questions and 'what if's' about plants that led to further explorations including a cloning project."

❖ Teams of students in Sally DeRoo's 9th/10th grade class in Plymouth, MI, planted, cared for, measured, and predicted growth rates of amaryllis bulbs. "One of the bulbs showed few signs of growth," said Sally, "and its caretakers were disgusted. Then suddenly it shot up and had an even larger flower stalk than the others. These tough high school boys experienced such awe and amazement when the eight gorgeous blooms appeared."

"How could this perfect, beautiful flower come from that little bulb?" one student remarked in amazement. Students became gentle caretakers, and even offered to "babysit" for one another's bulbs. Students shared their bulbs with the school office where they reportedly delighted staff and visitors for months.

❖ Second and third grade classes in Yelm, WA, reports Cyndy Johnson, initiated a blooming contest with their respective class amaryllis bulbs. Students exchanged daily visits to observe, compare, measure, chart growth, and to cheer on the bulbs. As they read the book *A Flower Grows* by Ken Robbins, (see review on page 12) they compared the growth and development of their bulbs to those in the book. Cyndy described how students began to notice that each amaryllis leaned in a different direction and wondered why that might be. After further observation and discussion they concluded that the plants received light from different directions since the classrooms were on different sides of the building—a firsthand lesson in phototropism.

Green Tips for an Early Spring

Bulbs can store energy (food) in the form of starch to fuel their seasonal growth cycle. Because they contain a miniature plant with flower, stem, leaf and root parts, bulbs are ready to spring forth when conditions are right.

Many bulbs native to tropical climates adapt well to classroom conditions and, with minimal care, will produce resplendent flowers during our winter months. Others, typically planted outdoors in fall, your students can stimulate or "force" to bloom indoors during winter.

Obtaining Bulbs

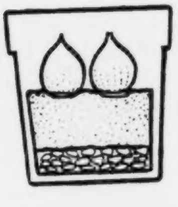
You can purchase (or try to get donations of) flowering bulbs in the fall at nurseries, garden centers, and through mail order catalogs. When buying spring-flowering bulbs such as daffodils, tulips, crocuses, or hyacinths, buy, if available, ones labeled "good for forcing." Pick bulbs that appear smooth and firm and feel heavy. Very inexpensive bulbs are sometimes small and may take a long time to bloom, or produce fewer blooms.

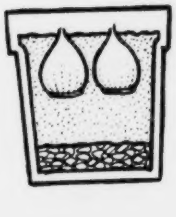
Breck's Bulbs has offered *Growing Ideas* readers two special bulb collections, specially chosen for successfully growing in classrooms. See page 12 for details.

Materials and Planting

If you can't plant your bulbs as soon as you get them, store them in a cool (35 to 50 degree F) spot until ready to plant. Whether you're growing tropical bulbs like amaryllis or forcing spring-flowering bulbs, you can use any type of well-drained containers. One teacher reported a successful bulb project using recycled plastic containers from a local deli. Barbara Dixon's 1st graders in Loveland, OH, raised crocuses in recycled school milk cartons. Containers should be about twice as deep as the length of the bulb.

You can grow bulbs in a commercial, well-drained potting mix. Should you want to make your own mix, try combining one-third commercial potting soil, one-third peat moss, and one-third sand or perlite. To improve drainage, consider covering the drainage holes in the bottoms of the pots with pebbles, rocks, pot shards, or white plastic "popcorn" used in shipping. Then fill the container half full of moist potting mix and set each bulb with its flat end down and its tip half an inch below the pot rim. You can put more than one bulb to a pot as long as you leave half an inch between bulbs and to the edge of the pot. Continue adding soil until only the tips of the bulbs are showing, then water thoroughly.

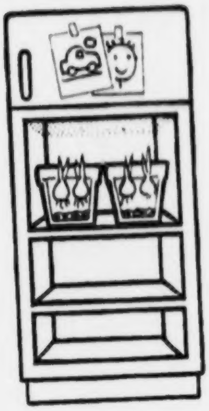




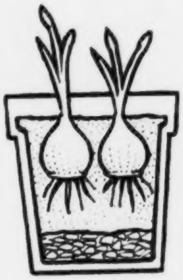
Coaxing Spring Bulbs

Spring bulbs are typically planted in the ground in the fall where they spend a cold winter, not resting but growing roots which give them a head start on the spring. Because true bulbs contain a miniature plant and stored food (starch), they're ready to spring forth when conditions are right for flowering. By simulating the natural conditions that bulbs experience outside, you and your students can coax bulbs to bloom during mid-winter.

Why not challenge your students, as a class or in small groups, to brainstorm how to provide a "winter" for your potted bulbs? If you have enough bulbs to spare, have students test several of their ideas, even those you think may not succeed. Ideally, the potted bulbs should be kept at temperatures between 35 and 50 degrees, and placed in paper bags or under boxes or burlap to exclude light. Consider leaving them in a cool cellar, unheated garage, or refrigerator, or buried in a cold frame under soil or leaves. Check the soil every four weeks, and water if it's dry to the touch.



Leave the bulbs under these cold conditions for 10 to 15 weeks by which point a root system and small pale shoots will have emerged. To encourage strong shoots and to acclimate them to new conditions once you bring them out, keep bulbs out of direct sun or bright light for several weeks. Water when dry to the touch and watch as the white shoots turn green as they photosynthesize. As soon as flower buds appear, put them in brighter light on a windowsill or GrowLab. Once the flowers bloom, in about 2 to 3 weeks, less direct light and cooler temperatures will encourage them to bloom longer.



Although most bulbs cannot be forced to bloom *indoors* more than once, many stand a chance of blooming the following year if planted at the recommended depth outdoors once the weather has warmed in the spring. (Note: Tulips that have been forced will typically not bloom again.)

Paperwhites--No Need to Chill

Paperwhite narcissus can be forced to bloom in the winter without cooling. They do best when planted in a container without drainage holes, filled with pebbles to one inch below the rim. Add water to barely below the top of the pebbles, then set bulbs on top and add enough pebbles to cover a third of the bulb. Maintain that water level and leave the bulbs in a cool location with little or no light for a week or two. Tug gently on the plants from time to time to test for root development. Once they feel rooted, move them to a well-lit spot without direct sunlight. They should flower in 3 to 5 weeks.

Amaryllis—Tropical Treasures

Amaryllis, tropical natives, are dramatic, fast-growing bulbs with brilliant blooms bound to captivate your classes year after year. Unlike bulbs from cool climates that require chilling, the amaryllis hails from warm climates, and will bloom 4 to 6 weeks after planting, with little care.

Plant amaryllis in moist potting mix with 1/2 to 2/3 of the bulb protruding above the soil. Since amaryllis thrive in cramped quarters, leave no more than 1/2- to 1-inch of space between the bulb and the container. Leave the pot in a warm well-lit spot, and don't water it again until the first leaf or flower bud starts to grow. Then keep the soil moist. Since timing varies, this should provide some suspense for your sharp-eyed classroom observers.

Flowers will usually appear in five or six weeks. When they appear, move the plant to a cooler, less lighted spot to lengthen the life of the flowers. The size and magnificence of amaryllis flowers invites close exploration of flower parts and of pollination, seed, and fruit production. Like other lily

(continued on pg. 12)

Bulbs Across the Curriculum

SCIENCE INVESTIGATIONS/QUESTIONS:

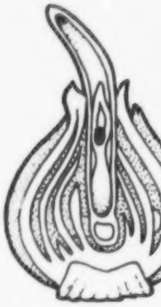
- Experiment with different methods for chilling bulbs for forcing. Explore whether and how the length of "winter" affects the bulb's growth and flowering. Discuss why some bulbs require this treatment. What does this tell us about their climatic adaptations? How do you think this adaptation promotes their survival?
- Compare growing bulbs in potting mix with and without bonemeal or bulb fertilizer.
- Discover the difference between bulbs (e.g., tulip) and corms (e.g., crocus) by dissecting and comparing one of each.
- Dig up bulbs at different stages of being "chilled." Predict, then examine them to discover what occurs at different stages.
- Slice one bulb vertically and another one horizontally to compare and observe their structure.
- Compare the growth and development of different size bulbs.
- Try raising amaryllis from both seeds and bulbs. Have students consider why bulb-like structures are useful adaptations for reproduction.

HISTORY/GEOGRAPHY ACTIVITIES:

- Find out about the history of bulbs and trace their movement across the globe.
- Learn about the cultural, economic, and aesthetic roles of bulbs in Holland.
- Find out which bulb-like plants are used as foods in different countries. Then have a classroom bulb-tasting party.

MATH ACTIVITIES:

- Measure bulb height and chart growth over time.
- Calculate the growth rate in inches or centimeters per day.
- Compare the growth rates of different types or sizes of bulbs.
- Determine when to plant different types of bulbs if you want to have flowers on a certain date.
- Design and conduct a survey for parents, neighbors, and other teachers to learn about bulb-growing habits and preferences.



LANGUAGE ACTIVITIES:

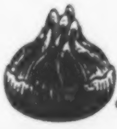
- Using bulb catalogs, have students cut out bulb pictures and names, and create a collage or Lotto-type game.
- Read *The Secret Garden* and identify references to bulbs.
- Write a big book/biography about a classroom bulb.
- Create a story, from a bulb's perspective, about its life cycle.
- Write thank-you notes and stories about your class bulb projects to share with Breck's Bulb Company and with the National Gardening Association.

ARTS ACTIVITIES:

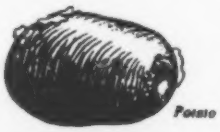
- Raise bulbs for holiday gifts in decorated, recycled containers.
- Dramatize the life of a bulb throughout a year, highlighting the different stages through which it progresses.
- Illustrate garden journals with sketches of different stages of classroom bulbs.
- Try cutting some bulbs in different ways and making prints with tempera paints.

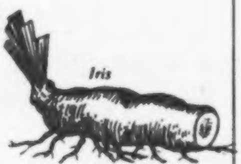
A Bulb by Any Other Name

The word **bulb** loosely describes plants that grow from an underground mass of food storage tissue. True bulbs, like tulips and daffodils, contain a complete miniature plant surrounded by fleshy scales of food (mostly carbohydrates) to nourish the plant–all attached to a basal plate from which roots grow. If you slice a bulb in half horizontally, you'll see rings formed by the scales (an onion is a great example!). If you slice one vertically at planting time, you should see a miniature plant.



Corms, like crocuses, are modified stems containing food, with eyes from which flowers and leaves grow. **Tubers**, like potatoes and begonias, are underground stems that store food and grow from eyes on the surface. **Rhizomes**, like iris, are horizontal stems at or below the surface. Consider bringing in samples of different bulb-like plants for students to examine, compare, plant, dissect, and/or use in their own growing experiments.





KEEP OUR NETWORK GROWING!

☑ Survey

We're pleased to have you as a member of the growing national network of educators using classroom gardening to stimulate learning. Sharing your classroom gardening experiences can help make the network a useful resource for teachers nationwide, and will help us develop partnerships and resources to meet your instructional needs.

Please take a few minutes to complete this survey to inform or update us on your efforts. Let us know whether you'd like to begin or continue receiving **free issues of *Growing Ideas*,** and return the form to: **Editor, *Growing Ideas*, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.**

☐ **If you are not a classroom teacher, but a "partner" working with educators, please check this box and fill in what's appropriate on the survey. We'd like to call to find out more about your efforts.**

Name ______________________ Title ________________ Grade __________

School/Organization ________________ Street ______________________________

City ____________________ State ____ Zip __________ Phone ______________

☐ Please begin/continue my free subscription to *Growing Ideas.*

☐ Please send me a GrowLab brochure (with a Sensational Seeds poster) and order form describing GrowLab curriculum resource books, GrowLab Indoor Gardens, videos, posters and other resources.

1. Which type of growing setup are you using in your classroom?

- ☐ GrowLab (prefabricated)
- ☐ Other commercial indoor light unit
- ☐ Windowsills
- ☐ Other ____________________
- ☐ GrowLab (homemade from our plans)
- ☐ Other light unit (made from your plans)
- ☐ Greenhouse
- ☐ Outdoor garden

2. With how many students per year are you gardening indoors? ________ students per year.

3. If applicable, in what year did you start using GrowLab Program resources and/or equipment? ______________

4. Which, if any, GrowLab Program resources have you used?

- ☐ *GrowLab: A Complete Guide to Gardening in the Classroom*
- ☐ *GrowLab: Activities for Growing Minds*
- ☐ *Growing Ideas* newsletter
- ☐ GrowLab training (by National Gardening)
- ☐ Introductory video, "A Growing Experience"
- ☐ Teacher resource videos
- ☐ GrowLab training by ______________________

5. From where did you get funds or donations for your indoor gardening equipment and supplies?

- ☐ school budget
- ☐ district or state grant
- ☐ local business
- ☐ corporate grant or donation from: ______________________
- ☐ other (describe below)
- ☐ chapter 2 funds
- ☐ PTO
- ☐ horticultural organization (club)

6. Briefly describe some of the activities that have been highlights of your classroom indoor gardening experience.

7. Describe ways in which your classroom gardening efforts have benefitted from outside support or "partners" (e.g., volunteers, material donations, funding).

8. What are some tools with which you assess what your students have gained from their growing experiences? Please describe some significant gains.

9. Our Growing Ideas Classroom Exchange is a forum for gardening classrooms to share information. If you'd like to be included in our Exchange pamphlet, list what your class would like to exchange with other gardening classrooms.

☐ pen pals
☐ specific experimental data
☐ classroom videos
☐ seeds (from local plants, special seeds, "space" seeds, etc.)
☐ classroom-produced videos
☐ other (please describe below)

11. Have you given GrowLab presentations or workshops for other teachers? (Please describe.) Would you like to?

12. How did you hear about our GrowLab Indoor Gardening Program?

☐ state or national educators' convention (which one?) ______________________________
☐ mail brochure
☐ other teachers, curriculum coordinator, or science supervisor
☐ advertisement in ______________________________
☐ article in ______________________________
☐ other ______________________________

13. Please list names and school addresses of other teachers who might like to receive information on plant- and garden-based educational resources (attach another sheet, if necessary.)

Growing Partnerships

When roles are switched and students become teachers, it can be a growing experience for everyone. Jim Micarelli, Science Department Head at Everett High School in Everett, MA, wrote to describe an innovative GrowLab workshop for elementary teachers which incorporated an unusual group of presenters—their former students turned high school seniors.

As part of revising the elementary science curriculum, Everett elementary schools are adopting GrowLab. An initial teacher-taught workshop introduced GrowLab to 93 teachers. Micarelli then sought a novel kind of follow-up workshop to inspire the teachers even further. He challenged Everett High School seniors studying Advanced Placement Biology to become the workshop leaders and instruct their former teachers.

Working in teams, the students chose a topic or activity from the GrowLab curriculum and over several weeks conducted their own research or experiments. Then during a GrowLab teacher workshop, each team presented a five- to seven-minute talk complete with visuals, demonstrations, creative ideas, and humor. The student instructors created curriculum webs, showing how GrowLab could be integrated into other subject areas. They helped teachers understand such topics as overcrowding with "Make Room for Raddy," plant propagation with "Plantenstein," and phototropism with "A-Maze-ing Light." They also shared some of their "failures" and suggested how participants might modify the activities for the classroom.

Participating teachers enjoyed a rare opportunity to see, firsthand, the results of some of their past teaching efforts. "Wow! This is the best workshop I have attended," reported one participant. "I can't believe it...he was so shy in my fourth grade class, and now he is teaching me."

"It is so nice to be standing here, on this side of the desk, keeping 93 teachers after class!" remarked one of the student instructors. Said Micarelli, "The students were really able to realize the depth of the concept 'to teach is to learn twice.'"

"The workshop seemed pivotal for motivating teachers to use GrowLab activities," said Micarelli. "The high school students basically demonstrated how easy and fun it was and that if they could do it, their former teachers could do it. Two months after this workshop was presented, the elementary classrooms turned green with 'Salad Celebration' parties, marigolds for Mother's Day, and just a general excitement and interest about plants."

Resources

Funding GrowLab: Try Ike!

Every school district in the country has a pool of money available to improve science and math instruction in public and private schools through the Department of Education's Eisenhower funds (formerly known as Title II, EESA). GrowLab teachers and partners nationwide have used these funds for GrowLab minigrants, as well as GrowLab inservice and preservice workshops.

Within every state, Eisenhower money is available both to local school districts and higher education institutions. Half of the school district money is distributed equally to all districts and the other half is allotted according to low-income enrollment. Local districts can use these funds for such activities as: science inservice training; training and equipment tied to specific instructional programs such as GrowLab; integrating problem-solving skills into the math and science curriculum; and minigrants to individual teachers for instructional materials and/or projects to improve teaching skills. The portion of Eisenhower money awarded to institutions of higher education must be used to work in partnership with local elementary or secondary school teachers to improve science instruction.

Obtaining Eisenhower Funds

Eisenhower funds are usually administered locally through either: 1) the office of the science and math supervisor; 2) the local grants administrator; or 3) the superintendent of schools. Start by finding out which of these offices administers the funds in your area and what activities this money funds in your district. Districts must apply for the money by June 30 each year, and identify how they will use the money for the coming year. Many districts involve teacher advisory groups—a nice opportunity to get involved in this planning process.

Also find out who coordinates the state's higher education Eisenhower funds. Consider collaborating with local science or education university faculty to develop a grant proposal for a GrowLab teacher inservice program. If you're preparing a proposal, contact the Education Department here at the National Gardening Association for samples of successful GrowLab-based Eisenhower proposals.

Book Review

***A Flower Grows*, by Ken Robbins. New York: Dial Books, 1988.**

This beautiful picture book details the astonishingly rapid growth of the amaryllis. Detailed paintings demonstrate the necessary steps that the gardener must follow for this unusual plant to grow. A seven-page series of paintings highlights the flowering of the bulb. First, we see the bud itself, ready to burst forth. Subsequent illustrations show the gentle awakening of this magnificent flower. The decline of the flower is shown too, and the need for the green leaves to remain to replenish the bulb's food supply is stated. An author's note gives instructions for planting and nourishing the reader's own amaryllis. The artwork, created from black and white photographs hand colored by the author, has a gentle, evocative quality. Once the story is shared, the class might well enjoy following the steps included to grow their own amaryllis.

Reviewed by Diane Elliott-Weaver, 5th grade teacher in Champaign, IL.

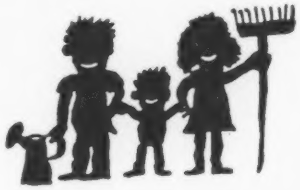
1993 National Gardening Grants Available

NGA's tenth anniversary National Gardening Grants are available to schools and other groups gardening outdoors with young people. Thanks to generous support from the companies listed below, we will award 150 grants to exemplary youth programs doing food gardening or beautification projects. Each award includes at least $500 worth of gardening equipment, seeds, bulbs, and educational materials.

NGA grant winners demonstrate strong project leadership, clear and creative educational objectives, community and neighborhood support, long-term sustainability, and need. Garden Grant applications must be completed by November 13, 1992, so request one soon by sending a legal-sized, self-addressed envelope with 52 cents postage affixed to: **National Gardening Association, Dept. NGGP, 180 Flynn Avenue, Burlington, Vermont 05401.**

Thanks to the following fine companies for donating products awarded in the 1993 National Gardening Grants Program.

Ames Lawn & Garden Tools ❖ W. Atlee Burpee & Company ❖ Applewood Seed Company ❖ Breck's Bulbs ❖ Cooper Instruments ❖ Flora & Fauna ❖ Ferry-Morse Seed Company ❖ Gardena ❖ Gardener's Supply Company ❖ Gardex Tools ❖ Jackson & Perkins ❖ LaMotte Chemical Company ❖ Ringer Safer ❖ Schultz Company ❖ Springfield Instruments ❖ V & B Manufacturing



(Amaryllis, from pg. 8)

family members, the flowers have 6 petals and 6 stamens surrounding a pistil. Once the flower is open, have students observe the parts carefully to discover signs of the flower's readiness for pollination. (The 3 prongs of the pistil actually open upward when the flower can accept pollen.) Invite your class to "play the bees," using a cotton swab or paintbrush to transfer pollen from one flower to another. Following successful pollination, a swelling containing ovaries and then seeds will emerge at the base of the flower. It would take 2 to 3 years to grow a flowering plant from these seeds.

To make amaryllis bloom another year, cut off the flowers once they've withered, but leave the stalk and leaves. Leave the plant in a sunny window or GrowLab, and treat it as you would any houseplant, watering and fertilizing regularly. Leaves require light, nutrients, and water to photosynthesize and produce food for another year of growth and flowering. The leaves will turn yellow and die in late summer or fall, signalling the plant's dormancy. Remove the leaves, stop watering and fertilizing, and store the pot in a cool basement until signs of new growth appear in the winter, and the cycle begins again.

Free Bulbs

Breck's Bulbs is offering two special bulb collections free to *Growing Ideas* readers for classroom bulb projects. **Collection A** includes daffodils, tulips, hyacinths, crocuses, and paperwhites for forcing. **Collection B** includes two amaryllis bulbs.

To order: Specify Collection A and/or collection B in your request. Mail your request and your mailing address (no P.O. boxes) by November 15 along with $2.50 **per collection** for postage and handling to:

Breck's Bulbs, Dept. NG, 6523 North Galena Road, Peoria, IL 61632

A JOURNAL OF GARDEN-BASED LEARNING

Growing Ideas

Published by the National Gardening Association

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GrowLab Curriculum Offer

"What do you mean there are two GrowLab books?" an elementary teacher recently asked us. She had received the classroom gardening resource, *GrowLab: A Complete Guide to Gardening in the Classroom*, but had not realized that we also offer a nationally recognized, 300-page, K-8, plant-based curriculum guide, *GrowLab: Activities for Growing Minds*. We believe that this educator-developed activity guide is an essential resource for growing classrooms. To encourage you to decide for yourself, we'll send you a free copy to examine for 30 days. See page 11 for details.

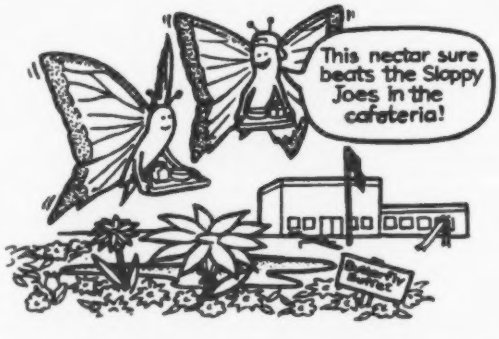
GrowLab Presentation Help

If you'd like to share your growing experiences with colleagues through informal school or district presentations, inservice workshops, or at local, state, or national professional conferences, we'd be happy to help you. Contact the Education Department at NGA for a GrowLab video and presentation packet as well as brochures, newsletters, and other handouts. A limited number of honoraria (up to $50) are available to help cover expenses for state, regional, or national conference presentations.

Learning Takes Flight

"Too often children are asked to save the whales, the rainforest, the Earth," says habitat educator Judith Levicoff from the Philadelphia area. "Although they're all important issues, they are overwhelming concepts to a child. Children live in the moment and need immediate results for their efforts. Butterfly gardens are a way that kids of all ages can think globally and act locally."

Thanks to Judith's Magical Migrating Monarchs program in urban Philadelphia schools, elementary and middle school students in 14 classes raised Monarch butterflies indoors from caterpillars during the fall, then tagged and released them and charted their fall migration south. When the tagged butterflies are found by field scientists, the information helps provide researchers with important data on habitats. That winter, students learned about butterfly habitat needs, then worked in teams to select plants, plan, and plant gardens in schoolyards or lots in the community. Classrooms soon sported butterfly bulletin boards, poetry, migration maps, growth charts, and metamorphosis songs while schoolyards and community lots blossomed with flowers and butterfly wings.


This nectar sure beats the Sloppy Joes in the cafeteria!
Butterfly Buffet

Across the country, butterfly gardening indoors and out has sparked a metamorphosis of students' understanding about basic needs, life cycles, habitats, adaptations, plant/animal interactions—and about making a difference in our environment. Here are some highlights from classrooms that have taken wing:

❖ Ginny Elliott's third graders in Tama, IA, used their GrowLab to raise native host plants for butterfly larvae as well as nectar plants for mature butterflies. They collected seeds of native prairie species, simulated winter by chilling them, then successfully raised some indoors. "Although we set some in the butterfly garden," said Ginny, "the students made sure to return some plants to their original location."

(continued on page 6)

Exchange

Seeds of Change

Like many other elementary students across the country, fourth graders in Orange, VA, are expected to learn about monocots and dicots. In Carol Hunter's school, this often cursory exercise blossomed into a multidisciplinary unit linking science, social studies, language, and art. While studying the exchange of seeds and ideas after Columbus's arrival in the New World, 90 fourth graders explored the Native American system of companion planting corn (a monocot), beans, and squash (dicots).

Using seeds from Native peoples of the Southwest*, seed donations from parents, and Aztec blue corn from the Smithsonian, fourth graders worked in groups to plant in the GrowLab, care for and study the history of these "three sisters."

"We engaged the students in art and writing projects reflecting the types of records that have helped us understand what crops ancient people grew," Carol explained. Students observed pictures of Mayan and Aztec stone carvings of plants, for instance, then created their own artistic renditions. After reading historical records of plants, students created their own plant journals. "This unit generated an incredible interest in plants among our students," said Carol. "Students continue to notice and bring in seeds from the wild—even from their squash suppers—and ask to plant them in the classroom. The project generated a great respect for plants and a sense of hope that plants, people, and cultures survive dramatic changes."

* Native Seeds/SEARCH is a nonprofit seed conservation organization focusing on the traditional native crops of the U.S. Southwest and Northwest Mexico. **For a catalog of native seeds and related books, send $1 with your request to Native Seeds/Search, 2509 N. Campbell Ave., #325, Tucson, AZ 85719.** (Note: If you have any Native American students in your class, you will be able to receive seeds free of charge through the catalog.)

Plant Sleuths

"My students learn early on that I won't give them answers," said fifth grade teacher Horace Puglisi in Essex, VT. "I want them to learn what science is all about, not by looking at pictures in a book but by rolling up their sleeves, getting close to the subject, and constructing their own understanding of the world."

With this philosophy in mind, Horace initiated his three-week Lost Plant Study unit. In late summer, Horace digs up and pots 30-40 wild indigenous plants including weeds, tree seedlings, and ferns. He's found that plants survive best if left outside for a week or so before being brought into the classroom.

Horace then challenges his students to discover, like other great scientists, the identities of the mystery plants. Students use microscopes, do macro and micro drawings, have access to a range of plant identification books, and ultimately identify and verify their plants. Each student then creates a "lost plant booklet."

Once the classroom scientists have identified all plants, they use the computer to develop a database featuring Latin and common names, location, and other data, then develop their own unique taxonomy to categorize the different types of plants. Also using a computer, students write letters to a fictitious plant society describing and touting their investigation and discovery.

"The students are actively investigating and thinking the whole time," reported Horace. "I knew it had been worthwhile when, long after the unit during a geology field trip, one student excitedly shouted, 'Hey, Mr. Puglisi, there's my lost plant!'"

Growing Ideas is published three times a year by the Education Programs Department of the National Gardening Association. *Growing Ideas* provides instructional ideas, horticultural information and a forum for exchange among teachers using classroom gardening to stimulate learning.
For a complimentary issue of *Growing Ideas*, write to: *Growing Ideas*, National Gardening Association, 180 Flynn Avenue, Burlington, Vermont 05401.
Editor: Eve Pranis
Contributor: Karin Hess

Sprouting Off

For several years, Roger Crowley's third grade students in Montpelier, VT, have become silly about sprouts. They've written sprout stories, developed sprout characters, and magnified sprouts to project on classroom walls.

The sprout project germinated one year when a social studies unit on pioneers sparked student interest in sprouts as a food source. Another year, students grew enough sprouts (greened up in their GrowLab) to start a small business. They developed a logo and advertisements, and took orders for sprouts from the school cafeteria and a local deli. They used computer spreadsheets to keep accounts and estimate profits. "Our sprout tasting party was a big hit," said Roger. "We experimented with all sorts of combinations including sprouts on jello!"

Exploring sprouts in the classroom doesn't have to be *this* involved to provide opportunities for learning across the curriculum. Consider challenging your students to use what they've learned about seeds' germination needs to experiment with different methods of making edible sprouts. Page 23 in *GrowLab: A Complete Guide to Gardening in the Classroom* describes how to make sprouts in jars. Seeds can also be successfully sprouted in baskets, on paper towels, colanders, burlap bags—even stockings!

In addition to standard alfalfa and mung bean sprouts, you might want to try making edible sprouts from radish, lentil, sunflower, pea, wheat, rye, or broccoli seeds! Make sure to use seeds (from supermarkets, health food stores or catalogs) that are for eating and have not been treated with fungicides. **For a free catalog containing a range of unusual seeds for sprouting, write to: The Sprout House, P.O. Box 1100, Great Barrington, MA 01230.**

Gardening Videos, Anyone?

Many of you have expressed an interest in creating and exchanging student-produced gardening videos with other classrooms. The next issue of *Growing Ideas* will feature an article on how to successfully engage your students in creating and exchanging garden video "letters." In preparation for the article, we'd like to hear from those of you who have already done so. Use the enclosed survey form to fill us in on what you've done, and we may call you to find out more about your experiences.

Plant Sale Grows Kids

Sure, bake sales can help you raise money for your classroom gardening supplies, but consider the opportunities for learning, class pride, and individual growth as students plan and implement a schoolwide plant sale. Tie it in with Mothers' Day, and you've got another base covered.

Foresa Coe's "exceptional" nine to thirteen year olds in Wentworth, NC, cut their plant business start-up costs to zero by using recycled school milk cartons, popsicle stick labels, and donated soil and houseplants. They rooted hundreds of cuttings during the winter in preparation for a Mothers' Day plant sale. After plastering the school with creative posters annnouncing the upcoming sale, each student learned enough about one plant to show and describe a sample to another class. The student presenters explained the details of the sale and had each class make an appointment to shop. "It was amazing how the whole project and students' enthusiasm mushroomed," reports Theresa. "I even had students with severe speech problems giving plant sale speeches in front of 30 kids."

After projecting sales based on school enrollment, the students realized that their 300 plants might not fill the demand. A local nursery sold them garden seedlings wholesale which students marked up for resale. During the three-day plant sale, the young entrepreneurs dressed up, provided customers with information on plant care, collected money and made change, and beamed with pride.

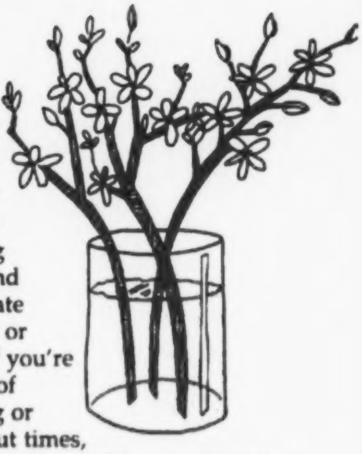
The hard-earned $400 profit which was used for school landscaping projects, gardening tools, and a pizza party was not the only gain, reports Foresa. "They were thrilled with the respect earned from the other kids, they gained social skills, math and business skills and, of course, an understanding of the needs of living things." Her advice to other teachers contemplating a similar project: be prepared for enthusiastic shoppers and for the project to go over even better than you'd dreamed. The first day of school this year Foresa's students were already eager to know: "when are we going to start planning the plant sale?"

While Foresa's students chose houseplants for their sale, we've heard of other class plant sales featuring such offerings as: potted herbs, marigolds, zinnias, pansies, vegetable seedlings, and bulbs. If you're raising plants from seed for a plant sale, refer to the back of seed packets or to the "Indoor Garden Growers' Guide" on pages 81-90 of *GrowLab: A Complete Guide to Gardening in the Classroom* to determine planting dates.

Green Tips

Bursting Buds

Although winter may still have an icy grip on your area, why not coax an early spring right into the classroom? Imagine the opportunities for branching out across the curriculum as students encourage bare branches to burst into flower or leaf in just a few weeks.



Once deciduous trees and shrubs outdoors have had a period of leafless winter dormancy, spring warmth causes sap to flow, buds to swell, and leaves and flowers to burst forth. Those that are pollinated by insects and other pollinators tend to have bright, showy flowers, while those that are wind-pollinated tend to have less conspicuous, though often fascinating, flowers.

To entice branches to bloom early, cut them about six weeks before they'd naturally flower in your area. As a general rule, cut early-flowering shrubs and trees in late January or early February and late-flowering shrubs and trees in late February or March. If you're not sure of flowering or leafing-out times, challenge your students to research or experiment to discover what blooms when.

Cut a 12- to 24-inch section of each branch, scrape it with a knife or scissors along a 3-inch length of bark at the bottom, then place it in lukewarm water for a day. Then move the cutting to a container of cool water and leave it in indirect light. Change the water and, if possible, cut an inch off the stem each week. Misting the branch several times a week will simulate spring rains and keep the buds moist and full. When the buds open in three to six weeks, move the cuttings to a bright location.

Early-flowering trees and shrubs (cut in late January/February)

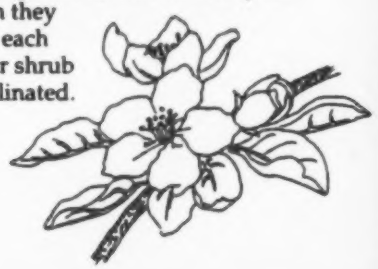
azalea
forsythia
mulberry
redbud
pussy willow
flowering dogwood
birch
hazelnut
elm
maple
plum
ash
sumac

Later-flowering trees and shrubs (cut in late February/March)

apple
crabapple
cherry
elderberry
mountain ash
honey locust

Branching Out with Buds

- Cut a variety of branches from unidentified trees and shrubs for forcing. Have students make careful observations and compare the different arrangements of buds, leaf scars, and other characteristics. They can use a winter twig key (or a tree and shrub guide once buds have appeared) to identify the plants.
- Try forcing branches under a variety of conditions, e.g., different water temperatures, light conditions, temperatures.
- Have students closely examine branches, then try to predict which will be leaf and which will be flower buds. They may then want to use pins or toothpicks to "dissect" and compare buds from different plants.
- Predict, then measure the rates at which different branches burst into bloom.
- Have students try to determine the ages of different twigs by observing the scars of the overwintering bud found each autumn. Where the bark color changes on a twig, fine lines like small bracelets mark the position of the terminal bud and end of last year's growth. Different lengths of annual growth between scars indicate differences in growing conditions. Encourage students to hypothesize what types of growing conditions might have affected growth in different years.
- Based on the characteristics of emerging flowers, have students make up stories about the ways in which they think each tree or shrub is pollinated.



Planting Questions:

The Heart of the GrowLab Classroom

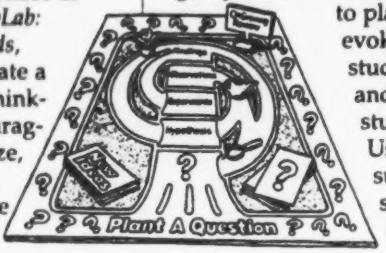
"A good question is never answered. It is not a bolt to be tightened into place but a seed to be planted and to bear more seed toward the hope of greening the landscape of idea."

—John Ciardi, author

All words related to questioning—question, quest, query, inquiry—come from ancient roots meaning "to go in search." Teachers question to search for students' existing knowledge, to encourage students to stretch their thinking and responses, to model problem-solving thinking processes, and to help students clarify their ideas. It becomes a cooperative relationship when a teacher dignifies an answer and deepens it, leading the student to further questing.

GrowLab classrooms are fertile ground for planting and exploring questions. Through each phase of the teaching cycle in *GrowLab: Activities for Growing Minds*, open-ended questions create a positive atmosphere for thinking and learning by encouraging students to hypothesize, give and justify opinions, express feelings, and share ideas. The reproducibles, such as "Plant a Question," page 282, and "Problem Solving for Growing Minds," page 283, guide students as they explore their own questions. Also consider using some of the strategies below with your growing explorations to help expand and refine your students' questioning and response skills.

We'd also like to hear about strategies *you* use to encourage students to plant questions, to evoke thoughtful student responses, and to respond to student questions. Use the enclosed survey form to share your techniques, thoughts and questions about questioning! We are currently designing staff development materials to help GrowLab teachers apply open-ended questioning, cooperative learning, and other effective teaching techniques to their plant explorations. Watch for updates in future issues of *Growing Ideas*.



Effective Questioning Strategies is one of the topics that will be explored in depth at National Gardening Association's Summer Institute for Staff Development Specialists. This intensive 3-day training is designed to help staff developers support GrowLab teachers. Other institute topics will include: Authentic Assessment in Hands-On Science, Cooperative Learning in the GrowLab Classroom, Peer Coaching, Integrating GrowLab Activities Across the Curriculum, and GrowLab in the Whole Language Classroom. If you'd like more information on our Summer Institutes, contact Karin Hess, our Professional Development Coordinator at (802) 863-1308.

Questioning Quickies to Stretch Thinking

WAIT TIME: Try waiting 3-5 seconds between posing a question and asking for a response. Researchers have shown that this will dramatically improve the length, variety, and number of student responses.

THINK-PAIR-SHARE: Pose a question, (e.g.: In what ways do people's activities affect plants?) then wait while students think, write, or draw a response. Have pairs of students discuss their responses, then share them with the class.

CLASS QUEST LIST: Keep a chart for recording ongoing questions that emerge spontaneously during gardening activities. Students can use the questions to get ideas for future investigations.

FOCUS INTERVIEW: Give each four-member team one to three questions about a particular concept (e.g., the greenhouse effect). Have students discuss the questions and share opinions, then record responses to share with the class.

"COOPERTY": (played like Jeopardy) Provide a list of answers (e.g., plant, seed, true leaves, etc.) and have teams of students brainstorm possible questions for each. Then have them choose their "best" questions and share them with the class on large charts. This is a great review activity.

FAT AND SKINNY QUESTIONS: Give teams of students plant materials (or pictures of plant materials) and have them generate lists of questions they'd like to have answered. Have teams classify the questions into "FAT" (those questions requiring more in-depth responses or investigations) or "SKINNY" (those questions that can be answered in a few words, on the spot). Later, fat questions can be used to shape investigations.

KWL: Create and divide a chart into three parts: Things We Know, Things We Want to Know, and What We've Learned. You can do this for individual journal pages, as a team assignment, or as a class.

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(continued from page 1)

Students also raised marigolds and zinnias and other annuals indoors to plant outside as nectar sources for their winged guests. They learned about the different conditions butterflies require to survive, and how to provide those conditions in their habitat. Students experimented with different types of plants and water supplies--one student even tried setting out a tray with rotten fruit to see which species it might attract. "In addition to learning about habitat needs and developing a greater appreciation for these creatures," said Ginny, "students came to understand that flowers and plants have much more importance than simply the aesthetic value we humans perceive."

❖ Challenged to create an outdoor butterfly habitat, students in Charles Whitefield's middle school science club in Alexandria, VA,first pored over books to learn about butterfly needs and plant types. Using information on plant heights, colors, bloom time, etc., they spent the winter planning, mapping, and ordering seeds for a butterfly garden. They experimented with different conditions for germinating seeds, then entered the data on the computer, and interpreted and discussed results in learning logs.

Charles reports that it's been a tremendous project for raising students' awareness of broader concepts of habitat destruction and loss. "Parents have reported that their kids have encouraged them to choose garden plants that will support wildlife," said Charles. "The students pay more attention to relevant newspaper articles. The project has helped them begin to develop an interest, the language, and tools to assess environmental issues."

❖ Students at more than 70 Palm Beach County, FL schools, as part of Project Butterfly Garden, are maintaining butterfly gardens, using mainly native plants and organic methods. Rotary Club members, Audubon and Sierra Club members, garden clubs, Boy and Girl Scouts, nursery owners, and Master Gardeners are helping students raise plants, create gardens, and identify butterflies. Some of the classrooms are also starting a pen pal link with schools from Canada to Mexico, sharing butterfly gardening stories and following the monarchs north in the spring and south in the fall.

Butterfly Garden Primer

Before beginning a butterfly garden project, it helps to understand what makes butterflies tick at different life cycle stages. The cycle begins when adult butterflies lay eggs on a "host" plant. Some butterflies will only lay their eggs on a single type of plant (e.g, monarchs and milkweed), while others have several choices. In about five to ten days, the egg hatches and the tiny caterpillar eats the host plant, shedding its skin four to six times as it grows. After two to four weeks, the full grown larva or caterpillar attaches itself to a twig or other object and transforms into a pupa. The body changes during this inactive stage and ten to fifteen days later the adult butterfly emerges. This process, called metamorphosis, means "change of form."

Adult butterflies feed on nectar from flowers (and in doing so, inadvertently pollinate some) while the larvae feed mostly on the foliage of plants. Ideally, a butterfly garden should contain or be located near a range of plants that will feed the butterfly at both stages.

Designing Your Garden

You need only a small bed in front of your school or in the community to create an inviting oasis for butterflies. Consider using winter months to read, research, and learn about butterflies and the plants that will attract them in your area. Students may want to use information from books and seed catalogs to map out a butterfly garden. You can use sunny windows, GrowLabs, or other classroom light gardens to begin growing many types of butterfly garden plants indoors during the winter.

Both butterflies and plants like sun so plan your garden with a southern exposure or in a site that gets at least six hours of sun each day. A site sheltered from the wind by trees, shrubs, or a building, will prevent tall plants from blowing over, and allow your butterflies to feed, mate, and lay eggs in relative tranquility.

Nectar flowers provide a source of food for adult butterflies. Butterflies are attracted to brightly colored, sweet-smelling flowers that allow them easy access. (Composite daisy-like flowers are favorites.) Some of the preferred, easy-to-grow nectar plants are: butterfly weed, lantana, butterfly bush, black-eyed Susan, purple coneflower, lavender, cosmos, zinnia, and marigold. Butterflies are attracted to masses of color and fragrance, so try to plant groups of flowers instead of single plants.

Host plants upon which butterfly larvae dine are often "weeds," wildflowers, shrubs, and trees native to the area. Some species will lay eggs on only one type of host plant, while others have a range. Some of the primary plants for butterfly larvae include: aspen, alfalfa, clover, nettle, pearly everlasting, milkweed, grasses, hackberry, parsley, vetch, and willow. Although the caterpillars of some butterflies, like the cabbage white, are considered vegetable garden pests, you should never use pesticides—even biological ones—in a butterfly garden or you'll destroy your intended guests.

Puddles or other shallow water sources are important, primarily for male butterflies, more as a source of salt and amino acids than as a water source. If you have no naturally occurring puddles, try sinking a shallow container filled with moist sand, dirt, and/or stones into the ground. Keep it moist and watch for large congregations of male butterflies and their drinking buddies.

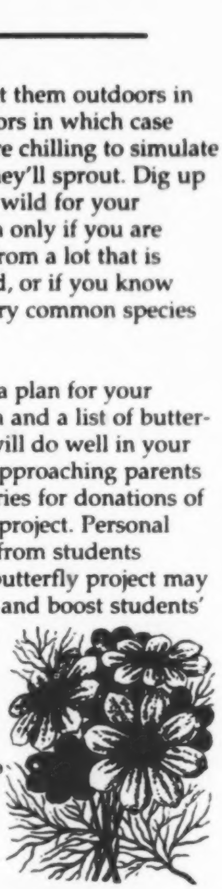
Dark stones in your garden can provide a warm spot where adult butterflies can bask in the sun and warm their bodies for flying.

Obtaining Plants

Some of the resources listed on page 8 include lists of butterfly nectar and host plants. To get further information on butterfly plants for your area, try contacting the local Cooperative Extension Service, your state's National Wildlife Federation chapter, or a local botanic garden or arboretum. During the warmer seasons, invite your students to conduct outdoor observations to discover what plants butterflies prefer.

Many butterfly nectar plants and some host plants are annuals or perennials that you can raise in your indoor classroom garden from seed, and transplant out to your butterfly garden in the spring. Marigolds, zinnias, parsley, cosmos, and black-eyed Susans are some butterfly garden plants that are easy to start indoors. In the fall, students can collect seeds of local plants, e.g., milkweed, once they have turned brown or black and fall easily from the flower. Plant them outdoors in the fall, or indoors in which case they may require chilling to simulate winter before they'll sprout. Dig up plants from the wild for your butterfly garden only if you are rescuing them from a lot that is being developed, or if you know that they are very common species in your area.

Once you have a plan for your butterfly garden and a list of butterfly plants that will do well in your area, consider approaching parents and local nurseries for donations of plants for your project. Personal visits or letters from students describing the butterfly project may elicit donations and boost students' communication skills. Nursery people might even be willing to help teach students how to plant, transplant, and take care of their garden.



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Classroom Metamorphosis

If you want to raise butterflies in your classroom, you can either order larvae through a science supply or nature catalog, or you can collect eggs or larvae outside and try to raise them indoors. In either case, time it so that the mature butterflies can be released as nectar flowers begin to bloom outdoors in the spring.

Although butterfly eggs may be hard to find outdoors, you may observe a female laying eggs or find a caterpillar on its host plant. In either case, make sure to bring in some twigs of the host plant so the caterpillar can continue to feed. Indoors, you and your students will want to recreate the environmental conditions that the young butterfly would find in the wild.

Containers must have food, air, humidity, and a comfortable room temperature out of direct sunlight. An aquarium with a screened lid, a large glass jar with holes in its lid, or a cardboard box with screening will do. Use a large enough container so a mature butterfly can expand its wings.

Keep the container relatively humid, but not too wet. Place a moist paper towel or newspapers in the bottom to maintain humidity. Keep the caterpillar supplied with leaves of the plant you found it on, or research other plants that species will eat. Clean out caterpillar droppings regularly from the bottom of the container. Extra twigs in the container will offer the caterpillar a place to crawl as it begins to pupate. Once the butterfly emerges and its wings are pumped up with fluid, move it outside, open the lid near your sanctuary, and hope that he or she likes the buffet.

Wings Across the Curriculum—Branch Out with Butterflies

- Keep journals or develop a class book to record observations, questions, predictions, and inferences about butterfly behavior and life cycles in your classroom and/or outdoor garden.
- Create maps, to scale, of your butterfly garden.
- Compare the habitat needs of butterflies with those of other animals, including humans.
- Discuss or write about other types of metamorphoses or transformations in nature or personal lives.
- Create butterfly kites, origami, masks, collages, etc.
- Observe and try to identify moths and butterflies in your area.
- Develop a newsletter to highlight your butterfly project for other students, teachers, and parents.
- Experiment indoors to determine which host plants caterpillars prefer.
- Survey your butterfly garden or wild areas outside to discover which types of plants different butterflies seem to prefer. Explore some of those plants more closely to discover whether they also attract other insects.
- Explore the adaptations that help butterflies avoid predators. Discuss the ways in which human "predators" might affect butterfly habitats and populations.
- Design a caterpillar cafe collage, illustrating favorite food and host plants for species in your area.

Butterfly Gardening Resources

Magical Migrating Monarchs

Judith Levicoff, educator and butterfly lover, has developed curriculum materials for a hands-on, interactive program to introduce children to the mysteries of the monarch, including their metamorphosis, migration cycle, and special habitat needs. For a complete description and ordering information, write to: Judith Levicoff, PO Box 212, Jenkintown, PA 19046.

Butterfly Garden Books

Teachers Yvonne Cataneo, Marlan McPhee, and Diane Elliott-Weaver at Southside School in Champaign, IL (along with NGA), recommend the following resources for your butterfly adventures.

Butterfly Gardening—Creating Summer Magic in Your Garden by the Xerces Society in association with the Smithsonian Institution, 1990. Sierra Club Books, San Francisco.

The Butterfly Book—An Easy Guide to Butterfly Gardening, Identification and Behavior by Donald and Lillian Stokes and Ernest Williams, 1991. Little, Brown and Co., Boston.

The Butterfly Garden—Creating Beautiful Gardens to Attract Butterflies by Jerry Sedenko, 1991. Random House, New York.

Butterfly and Caterpillar by Barrie Watts, 1985. Silver Burdett & Co.

Part of Silver Burdett's Stopwatch series, this easy to read book filled with close-up color photographs takes children through the life cycle of the butterfly.

Monarch Butterfly by Gail Gibbons, 1989. Holiday House.

This colorful picture book traces the story of the monarch butterfly from egg to adulthood. Migration paths of the monarch are indicated on a map. Activities communities do to celebrate migration are included as well as steps to follow in raising a monarch.

Butterfly Garden Reminders

- Grow lots of colorful nectar plants
- Grow caterpillar food plants (or make sure they're nearby)
- Choose a sunny, sheltered location
- Provide puddles
- Don't use pesticides

Butterfly Garden Seed Collection

Kathy Wildman, a nursery owner and butterfly garden promoter in Sunbury, OH, is offering *Growing Ideas* readers a collection of butterfly garden nectar and host plant seeds. The collection contains 10 packets of nectar plant seeds, 5 packets of host plant seeds, a list of butterfly garden plants, bibliography, and other "how to" butterfly gardening information. To order this seed collection and information, send a check for $6 to cover postage and handling with your request to: Kathy Wildman, 3977 Condit Road, Sunbury, OH 43074. Phone: (614) 965-2133. (Note: Kathy is also still offering vegetable, flower, and herb seed collections. To order, send $5 for the first and $2.50 for each additional collection.)

KEEP OUR NETWORK GROWING! ☑Survey

We're pleased to have you as a member of the growing national network of educators using classroom gardening to stimulate learning. Sharing your classroom gardening experiences can help make the network a useful resource for teachers nationwide, and will help us develop partnerships and resources to meet your instructional needs.

Please take a few minutes to complete this survey to inform or update us on your efforts. Let us know whether you'd like to begin or continue receiving **free issues of *Growing Ideas*,** and return the form to: **Editor, *Growing Ideas*, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.**

☐ If you are not a classroom teacher, but a "partner" working with educators, please check this box and fill in what's appropriate on the survey. We'd like to call to find out more about your efforts.

Name ____________________ Title ____________________ Grade __________

School/Organization ____________________ Street ____________________

City ____________________ State ______ Zip __________ Phone __________

☐ Please begin/continue my free subscription to *Growing Ideas.*

☐ Please send me a GrowLab brochure (with a Sensational Seeds poster) and order form describing GrowLab curriculum resource books, GrowLab Indoor Gardens, videos, posters and other resources.

1. Which type of growing setup are you using in your classroom?

- ☐ GrowLab (prefabricated)
- ☐ Other commercial indoor light unit
- ☐ Windowsills
- ☐ Other ____________________
- ☐ GrowLab (homemade from our plans)
- ☐ Other light unit (made from your plans)
- ☐ Greenhouse
- ☐ Outdoor garden

2. With how many students per year are you gardening indoors? ________ students per year.

3. If applicable, in what year did you start using GrowLab Program resources and/or equipment? ______________

4. Which, if any, GrowLab Program resources have you used?

- ☐ *GrowLab: A Complete Guide to Gardening in the Classroom*
- ☐ *GrowLab: Activities for Growing Minds*
- ☐ *Growing Ideas* newsletter
- ☐ GrowLab training (by National Gardening)
- ☐ Introductory video, "A Growing Experience"
- ☐ Teacher resource videos
- ☐ GrowLab training by ____________________

5. From where did you get funds or donations for your indoor gardening equipment and supplies?

- ☐ school budget
- ☐ district or state grant
- ☐ local business
- ☐ chapter 2 funds
- ☐ PTO
- ☐ horticultural organization (club)
- ☐ corporate grant or donation from: ____________________
- ☐ other ____________________

6. Would you like to attend a GrowLab workshop? ☐ yes ☐ no ☐ maybe
If so, please rank your 1st, 2nd, 3rd, etc. choices of the workshop topics below.

- ☐ cooperative learning with GrowLab
- ☐ alternative assessment for hands-on plant activities
- ☐ interdisciplinary, thematic projects
- ☐ other ____________________
- ☐ whole language with GrowLab
- ☐ horticultural basics
- ☐ science inquiry with plants

7. Briefly describe some of the activities that have been highlights of your classroom indoor gardening experience.

8. Describe ways in which your classroom gardening efforts have benefitted from outside support or "partners" (e.g., volunteers, material donations, funding.)

9. What are some tools with which you assess what your students have gained from their growing experiences? Please describe some significant gains.

10. Our Growing Ideas Classroom Exchange is a forum for gardening classrooms to share information. If you'd like to be included in our Exchange pamphlet, list what your class would like to exchange with other gardening classrooms.

☐ pen pals
☐ specific experimental data
☐ classroom videos
☐ seeds (from local plants, special seeds, "space" seeds, etc.)
☐ classroom-produced videos
☐ other (please describe below)

11. Have you given GrowLab presentations or workshops for other teachers? Would you like to? What types of assistance do you feel you would need?

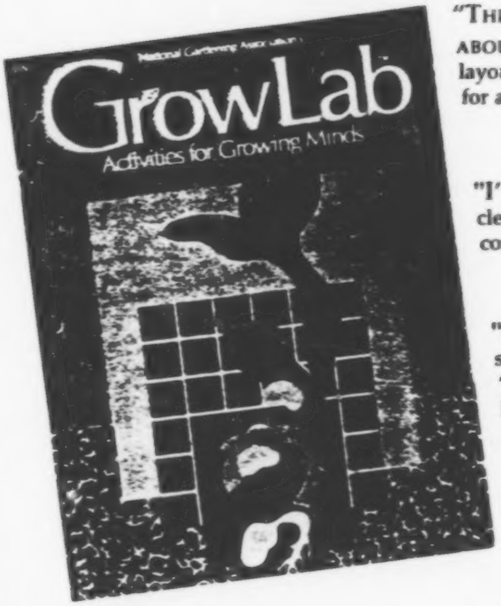
12. How did you hear about our GrowLab Indoor Gardening Program?

☐ state or national educators' convention (which one?) ____________________
☐ other teachers, curriculum coordinator, or science supervisor
☐ advertisement in ____________________
☐ article in ____________________
☐ other ____________________

13. Please list names and school addresses of other teachers who might like to receive information on plant- and garden-based educational resources (attach another sheet, if necessary.)

If You're Using Plants to Promote Learning. . .

...we want to send you *GrowLab:Activities for Growing Minds* free for 30 days. We feel confident that you will find it an indispensable resource for hands-on activities that inspire conceptual learning, problem solving and enthusiasm. Here's what your colleagues say about *Activities for Growing Minds:*



"THE ACTIVITIES ARE SO WELL EXPLAINED, THAT THERE'S NEVER A QUESTION ABOUT WHAT TO DO AND HOW. The time, materials, objectives and the entire layout make them easy to follow. The background information is thorough enough for any teacher to feel comfortable with the concepts."

—Deborah Hesselberth, Extension Agent, Rockford, IL

"I'VE BEEN VERY PLEASED WITH ALL THE ACTIVITIES I'VE USED. They're clearly explained, discovery oriented, and help me apply some of the standard concepts and skills in exciting new ways."

—Marla McAfee, resource teacher, Ft. Wayne, IN

"I EXTENSIVELY USE REPRODUCIBLES SUCH AS THE PLANT JOURNAL for students' ongoing plant observations. Activities like "Yo Seeds, Wake Up," "Lettuce Be Different," and many others fit in beautifully with our district's hands-on science program, and they're very educator friendly."

—Pam Fox, 3rd grade teacher, Frederick, CO

"EACH ACTIVITY PROVIDES A GOOD SEQUENCE SO I CAN START WITH BEGINNING CONCEPTS and run through a complete learning cycle. The materials lists are complete, the extension ideas compelling, and activities can be easily adapted for different durations and skill levels."

—Jeff Isham, elementary teacher, Moretown, VT

"THE EXERCISES REALLY GET KIDS THINKING and realizing that they can think through questions and challenges, come up with answers, and believe in their ability to solve problems."

—Karla Drover, 2nd grade teacher, Groveton, TX

☐ Yes. Please send me *GrowLab: Activities for Growing Minds* free for 30 days. I will either keep it and send $19.95 plus $3.00 for postage and handling, or I will return it in 30 days without further obligation.

Name ______________________________

School/Organization ______________________________

Street Address ______________________________

City ____________________ State ______ Zip __________

Phone ____________________ Grade ____________________

**Return to: National Gardening Association, Dept. GR1, 180 Flynn Avenue,
Burlington, VT 05401. FAX: (802) 863-1308.**

Resources

Free Planter Kits for Kids

Applewood Seed Company is offering a choice of two free gardening kits to classes wanting to take part in a research project. Participants must agree to complete an evaluation sheet and have room for a 6- by 6-foot garden in full sun. The PIZZA GARDEN FOR KIDS includes seeds to be started indoors for tomatoes, peppers and other toppings. The SUNFLOWER PLAYHOUSE has seeds for a sky-blue Morning Glory roof and tall Sunflower walls. Only the first 50 applicants will receive a kit.

Send your kit request (no P.O. boxes) to Applewood Seed Company, 5380 Vivian Street, Arvada, CO, 80002.

Sample Desert Seeds

Impressed by the school's focus on "real life" skills and environmental issues, a business owner donated a small seed company to the Career Center in Grand Junction, CO.

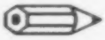
Career Center students raise and collect some of their own seeds in a native plant demonstration garden, buy the rest bulk, then repackage the seeds in a desert seed mix. Horticulture teacher Patty Doss has offered to send a free small sample of their desert seed mixture, which includes grasses, shrubs and flowers, to classrooms wanting to experiment with desert plants indoors or out.

To order a sample desert seed mix, send an S.A.S.E. and request to: Patty Doss, Sander Seed Co., P.O. Box 271, Grand Junction, CO 81502.

GrowLab Grant Help

The last issue of *Growing Ideas* featured an article on using Eisenhower math and science funds, available in every district, for classroom GrowLab Programs. Whether writing a proposal for an Eisenhower grant, another minigrant, or corporate or foundation funding, there are some basic types of information requested in most grant applications. To help you write a GrowLab grant, we've pulled together excerpts from other teachers' successfully funded GrowLab grants.

To request a GrowLab grant writing packet, send a self-addressed envelope with .52 postage to: GrowLab Grants, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.



Growing Ideas

A Journal of Garden-Based Learning
National Gardening Association
180 Flynn Avenue
Burlington, Vermont 05401

NON-PROFIT
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GARDENING
ASSOCIATION

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A JOURNAL OF GARDEN-BASED LEARNING

Growing Ideas

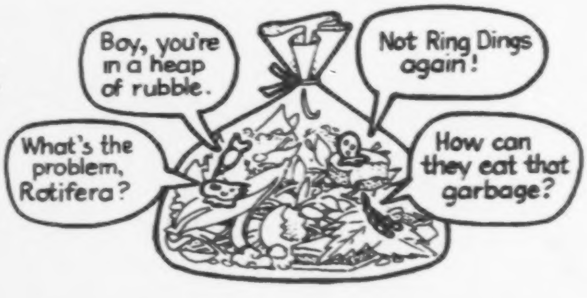
Published by the National Gardening Association

Volume 4, Number 2, April 1993

Rottin' Lessons: Cultivating Compost

"It was a terrific example of an accident that turned into a teachable moment," reports Minneapolis, MN, teacher Joanne Taft. "That's how my third and fourth graders learned about composting." When Joanne's students returned from a long winter break and discovered that many of their unwatered indoor plants had died, they dumped the moist soil mix and plant remains into a clear plastic bag to discard. But then they began to wonder what might happen to the materials over time so they made predictions and placed the bag in the warmth and light of a windowsill to observe. The steaming, changing contents inspired students to imagine what *other* types of things would (or wouldn't) change, so in went samples of lunchbox leftovers, aluminum pop tops, wood, and other items.

Decomposer Dialogue


Boy, you're in a heap of rubble.
Not Ring Dings again!
What's the problem, Rotifera?
How can they eat that garbage?

"By spring," says Joanne, "the bag contained a rich, dark soil. We combined it with potting mix to grow herbs and other seeds. Noticing which things *didn't* break down inspired a discussion of what happens to other types of garbage. We're now doing a lot more school recycling, and some of the kids have even started compost piles at home."

We've heard from teachers around the country who have used decomposition and composting as a springboard for a wide range of lessons. Their activities range from observing bread mold in the classroom to schoolwide worm-composting projects. Some classes focus on observing and measuring the physical and chemical changes that occur during decomposition. Many tie composting into studies of food webs and nutrient cycling. For others, composting is part of broader recycling projects, often tying in with local and state waste-reduction mandates.

"These kids are being bombarded with pleas to recycle and reduce waste," notes San Jose, CA, parent Michelle Steever. "But the concept of recycling things like bottles and cans versus the recycling that happens when things return to the earth can be confusing for kids. Seeing, feeling, and creating compost really helps them grasp the concept."

(continued on page 6)

Join Our Classroom Exchange

Through our *Growing Ideas Exchange*, hundreds of classrooms around the country can exchange videos, native seeds, experimental data, or find pen pals in other growing classrooms. Beginning this fall, we will recreate and update the *Growing Ideas Exchange* annually. If you would like to receive a form for your listing in the 1993/94 *Growing Ideas Exchange*, indicate so on the response form on page 12.

GrowLab Presentation Help

If you'd like to share your growing experiences with colleagues through informal school or district presentations, inservice workshops, or at local, state, or national professional conferences, we'd be happy to help you. Contact the Education Department at NGA for a GrowLab video and presentation packet as well as brochures, newsletters, and other handouts. A limited number of honoraria (up to $50) are available to help cover expenses for state, regional or national conference presentations.

This project was supported, in part,
by the
National Science Foundation
Opinions expressed are those of the authors
and not necessarily those of the Foundation

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GrowLab Grows with New Grant

We're pleased to report that a new four-year "Growing Science Inquiry" grant from the National Science Foundation will help us continue to support your efforts to help young minds grow. The activities under the new grant include:

- continuing the *Growing Ideas* newsletter and developing a *Growing Partnerships Update;*
- expanding and supporting our national network of GrowLab Partners;
- developing and distributing materials to help GrowLab presenters incorporate effective questioning, cooperative learning, alternative assessment, and other teaching strategies into GrowLab in-service workshops and courses;
- holding summer institutes for those wanting to become certified GrowLab presenters.

For a summary of Growing Science Inquiry project activities, or for details on mini-institutes for GrowLab presenters, contact the Education Department at the National Gardening Association. For regular updates on Growing Science Inquiry professional development resources, workshops, and our national partnership network, use the response form on page 12 to request a *Growing Partnerships Update.*

Exchange

An Aromatic Curriculum

The "Mini-Greenhouse Herb Factory Gardeners" is the class name chosen by Elba Iris Marrero's fifth and sixth grade special education students. They're immersed in an "herbal curriculum"—a multisensory, interdisciplinary approach to learning about different cultures through studying the role of herbs.

After interviewing their parents and inventorying the types of herbs used at home, students bring herb samples and recipes to class. "The fun and cultural exchanges begin," says Elba, "when students raid their kitchens and come back with herbs and tales of how they're used in their homes." Students also survey herbs sold at markets in the community, study herb folklore, and investigate how herbs originating in other areas came to be grown here.

The class creates indoor mini-greenhouses to grow their own herbs using old coat hangers, plastic wrap and other discarded materials. They read herb catalogs to determine best prices for seeds and supplies, chart seed germination and growth, and survey the faculty about scent preferences. Using potpourri recipes, they measure and mix homegrown and store-bought ingredients, then advertise and sell fragrant potpourris and sachets. "Other teachers have been so impressed," says Elba, "when I show them how creating or analyzing a bag of herbal potpourri can involve over ten different science inquiry skills."

If you're considering an actual herbal product business, Elba suggests getting a free catalog of herbs and potpourri supplies from the San Francisco Herb Company, (800) 227-4530. For a copy of our "Herbal Adventures" article featuring basic herb-growing tips and activity ideas, send a request with a stamped, self-addressed envelope to: **Herbal Adventures, National Gardening Association, 180 Flynn Ave., Burlington, VT 05401.**

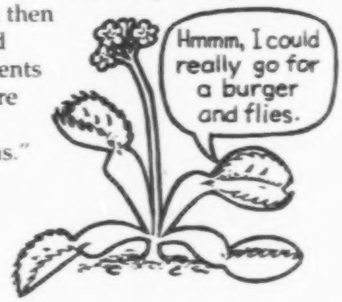
Free Herb Seed Collection

Shepherd's Garden Seeds is again offering a special collection of herbs to *Growing Ideas* readers. To receive a Container Herb Garden brochure and six herb packets (basil, dill, edible blossom chives, catnip, curly cress, and chamomile), send a check or money order (to cover postage) for $1.50 and request item #5999 from: **Shepherd's Garden Seeds, 30 Irene St., Torrington, CT 06790.**

Growing Ideas is published three times a year by the Education Programs Department of the National Gardening Association. *Growing Ideas* provides instructional ideas, horticultural information and a forum for exchange among teachers using classroom gardening to stimulate learning.
For a complimentary issue of *Growing Ideas*, write to: *Growing Ideas*, National Gardening Association, 180 Flynn Avenue, Burlington, Vermont 05401.
Editor: Eve Pranis
Contributors: Karin Hess, Larry Johnson, Nancy Jurenka

Plants That Bite Back

If you thought growing bulbs inspired your students' imaginations, consider the possibilities of nurturing *flesh-eating* plants in the classroom! Sylvia Shepherd, a third through fifth grade science teacher in Wake Forest, NC, reports that the Venus flytraps and other carnivorous plants in her classroom inspired creative investigations and understanding of adaptations, nutrient needs, and special habitats. "The carnivorous plants became a focus for questioning and problem solving," reports Sylvia. "Students wondered whether the plants would 'eat' fruit, what types of insects they preferred, whether they'd respond to smell, then designed experiments to explore these questions."


Hmmm, I could really go for a burger and flies.

Carnivorous Clones Available

Hungry Plants Carnivorous Plant Nursery in North Carolina is offering special discounts on carnivorous plants to teachers interested in using them to help young minds grow. An exciting new product is "Your Own Clone™" Plant Tissue Culture Kit containing a Venus flytrap tissue culture with ten asexually propagated plants, soil, covered pot, and planting instructions.

To order "Your Own Clone," send a $5.00 check with your request to Hungry Plants Carnivorous Plant Nursery, Education Division, 1216 Cooper Dr., Raleigh, NC 27607. For a free catalog, including discounted products for educators, send a request on school stationery to the above address.

Bulbs Light Up Learning

"My preschool students were enthralled with the growth and development of our amaryllis and paperwhite bulbs," reports Linda Heisserman from Wallingford, PA. "We examined the bulbs and dried-up roots with magnifying glasses, then predicted the plant height and flower color. Students created individual amaryllis observation books that included paintings at different stages, measurements, and descriptions. "They were amazed at the number and size of the flowers emerging from the small bud. Long after the flowers dried up, we continued to observe the stalks on our science table," says Linda.

We'd like to hear about your bulb adventures for the fall issue of *Growing Ideas*. Please use the response form on page 12 to fill us in on your experiences.

Designer Pots

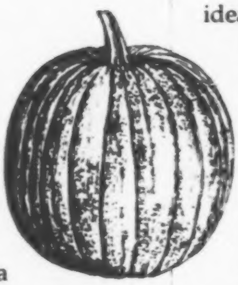
If you're short on pots but strong in the arts, consider creating your own pots for homebound plants. Gordon Joslin's second and third graders in Indianapolis, IN, lined 6-inch plastic pots with muslin, then lined the cloth with 1-inch clay balls and molded the clay to the inside of the pots. They let each pot sit a day, then removed the new clay pot and cloth and used a straw to poke drainage holes in the bottom. "We glazed the nicely textured pots before students took them home filled with seedlings, herbs, and houseplant cuttings," reports Gordon.

Rent-a-Plant

The budding entrepreneurs in Carolyn West's special education class in New York City chose "The Green Team" as the name for their interior plant business. Using their newly acquired knowledge about caring for growing things, these seventh and ninth graders raise houseplants from cuttings in their GrowLab, then advertise and rent plants to individual teachers and administrative offices, maintaining each plant for 50 cents a week.

The students are completely responsible for learning about the plants' needs and caring for them, maintaining good client relationships, and billing. When one of the plants die, students withdraw money from the business bank account to replace it. Even so, they've managed to raise $100 a month. "The project has helped students learn a range of useful business, math, and other skills," reports Carolyn, "but perhaps the greatest gain is in their responsibility and social growth as they maintain relationships with clients."

Literature Connections: A Pumpkin Flotilla



Pumpkins inspired Jackie MacGregor's second graders in Ellensburg, WA, last fall. They visited a pumpkin patch, brought back pumpkins, and carved them into eerie faces. In the library corner, students read *From Seed to Jack O'Lantern* by Hannah Johnson, *Your First Garden Book* by Marc Brown, and *The Pumpkin Patch* by Elizabeth King. After reading aloud *The Pumpkin People* by David and Maggie Cavagnaro, students insisted on taking a school bus to a nearby irrigation canal to launch a flotilla of jack-o'-lanterns, just as the people do in the book.

We heard about this project from reading educator and Master Gardener Nancy Jurenka in Ellensburg, WA. "There are so many ways in which teachers who garden with children can effectively connect reading and writing to events that have immediacy and authenticity," reports Nancy.

During visits to elementary schools, Nancy has gleaned many creative ideas for connecting gardening activities to language arts and reading. For a description of these activities, a bibliography of garden-related children's books, and information on an emerging special-interest group of the International Reading Association called GARDN (Gardeners and Readers Develop Naturally), send a legal-sized, self-addressed, stamped envelope to: **Nancy Allen Jurenka, Book Nook Farm, Rt. 1, Box 1038, Ellensburg, WA 98926.**

Garden Video Visits

by Larry Johnson

One of the finest experiences my students and I have had is touring different children's gardens around the world through a Garden Video Letter Exchange. It's not as good as going in person, of course, but it's much better than not going at all. My Minnesota students have been amazed to see their video pen pals from Ecuador first growing corn and then standing in a banana jungle, and to watch their Georgia pen pals harvest peanuts and cotton.

All you need to create a garden video letter is a thriving indoor or outdoor classroom garden, a blank videocassette, a camcorder, and a person with homestyle video experience to help your students show and tell what's going on in the garden.

What Should One Look Like?

Keep it simple and interesting--15 to 20 minutes is plenty. Let your students each narrate a small portion, introducing themselves and showing the school, the garden, and projects they care about. End with some questions about what you'd like to see in the return video. If you're not editing (few schools have the time or luxury), plan your shots and tape them in order, fading to black between scene changes.

What to show your video visitors is wide open, but it helps to think about it. Garden games you play? Students telling garden stories? A field trip to a garden-related place? How you turn lunchroom waste into garden compost? Garden songs from the spring musical? How you make things grow indoors? The seniors next door who help you with your school garden? Have students work together to plan, script, and possibly rehearse their scenes.

For visual variety, change scenes, showing different aspects of your garden program—GrowLab, composter, giant sunflowers, experiments, and so forth. Use a microphone or keep the built-in one close for good sound. When asking other classrooms to share, think visually about what you'd like to see. If you ask, "Do you like having a school garden?" someone could stand before the camera and say "Yes." If you say, "Please show us a garden game you play," they just might do it.

Who Should Do the Taping?

Ideally, the kids will learn to operate a video camera and plan and produce the video tour themselves. But whether students or adults do the actual taping, they shouldn't be locked in to creating a "professional" product. Certainly you don't want a sloppy video that can't be heard and makes you dizzy to watch, but keep in mind you're communicating with a small, friendly audience, not a national network.

Finding Video Pen Pals

You can find gardening classrooms across the country interested in exchanging videos through National Gardening Association's *Growing Ideas Exchange* described on page 1. Also consider contacting VIDEO PALS, a new organization setting up national and international video exchange contacts. The group has a low fee and, although it doesn't specialize in gardens, it will try to match your specific interests. Contact the group at 1-800-VID-PALS.

(continued on page 10)

The Garden Jigsaw: Cooperative Learning Stations

An effective way to manage a classroom of active students when teaching indoor gardening tasks is to organize a cooperative learning "jigsaw" in which each cooperative group becomes "expert" at a particular technique or gardening skill. Each expert can later teach his or her skill to another group of students or work with other expert group members to present a short demonstration to teach the skill to the whole class.

Designing Stations

Jigsaws work best when each expert group works at a station to complete a different task or variation of the same task (e.g., transplanting different types of plants). Stations might include: planting seeds • planting bulbs • thinning seedlings • transplanting seedlings • taking and rooting cuttings • planting different fruit and vegetable parts (e.g., citrus seeds, potato eyes, carrot tops).

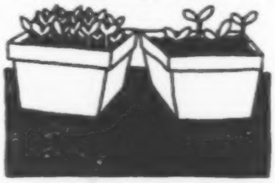
Setting Up Stations

1. Decide which tasks will be performed at each station and what information, directions, and materials students will need. Consider copying or excerpting "how-to" information from *GrowLab: A Complete Guide to Gardening in the Classroom* for students who can read at that level. For non-readers, consider providing a simple visual chart or preliminary demonstration.

2. Have materials readily available. A centrally located materials table is easier than preparing for each station individually. It should contain general supplies (newspapers, reference books, soil mix) and specific station supplies (scissors, bulbs, seeds). The groups should decide, based on the directions, which materials they'll need. The materials monitor in each group (see Cooperative Group Roles, below) is responsible for getting materials.

3. Decide which questions the experts should be able to answer or infer as a result of completing the task. Write these on a "Q-Card."

4. Prepare a folder for each station including the task definition, how-to information and instructions, Q-Card, and "role cards" (see Cooperative Group Roles, below).



Sample Student Information at Thinning Station:

"Thinning" is removing some plants from groups growing close together to let the remaining plants have more room and better conditions for growth. To thin a group of seedlings:

A. Look for the healthiest looking plants and remove the rest. Check the Planting Chart (pages 86-87 of *GrowLab: A Complete Guide to Gardening in the Classroom*) to see how many plants to leave in each container.

B. Remove the unwanted plants with your fingernail just at the top of the soil or very gently pull them out.

C. If you have thinned plants whose roots we eat (e.g., radishes or carrots), add a bit more potting mix to the pot.

D. Water the plants gently.

Sample Q-Card Questions on Thinning:

- *How did your team decide which plants were healthiest?*
- *Are there any plants in the room that you think should have been thinned already? What makes you think so?*
- *Why do you think you sometimes add more soil after thinning?*
- *Which method did you choose for thinning and why?*
- *What do you think we should do with seedlings that have been removed?*
- *What do you think would have happened in the container if you hadn't thinned?*

Procedure for Working at Stations

1. Teacher assigns or allows students to form "expert" groups of four or five.

2. Teacher assigns or allows students to choose cooperative group "roles" as described below. (You may want to keep track on a wall chart or job wheel so students can rotate roles for different activities.)

Cooperative Group Roles:

captain: reads directions orally and keeps track of time.

materials monitor: gets materials and supervises cleanup.

checker: double-checks that all materials are agreed upon before materials monitor gets them and questions group members to see that all directions are followed.

recorder: after listening to all group members, writes important information and illustrations on charts or worksheets.

presenter: is the main speaker and works with the recorder to clearly represent the group.

(continued on page 10)

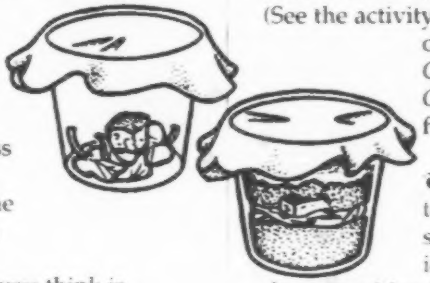
(Rottin Lessons, continued from page 1)

Exploring Decomposition

Decomposers, the final links in food chains, use dead plants and animals as food, breaking them down into smaller particles. Among the decomposers are fungi, which include the familiar molds and mushrooms. Other decomposers—called bacteria—are so small that a mere teaspoon of soil could contain billions of them.

Composting happens when humans promote this natural process of decomposition and nutrient cycling by creating an environment in which particular decomposers thrive. As the decomposers use the organic matter for energy and maintenance, they break it down into simpler molecules that can be used again as nutrients for plants, and the cycle begins all over again. This process also give off heat, which in turn speeds up decomposition. While microorganisms accomplish most of the chemical decomposition in a compost pile, small invertebrates such as sowbugs and earthworms are responsible for much of the physical breakdown of materials.

Although your students can't actually see many of the decomposers, they can explore their behavior up close. Whether you plan to build an outdoor compost pile or not, you can lay the groundwork with some exploratory activities. Consider the following:



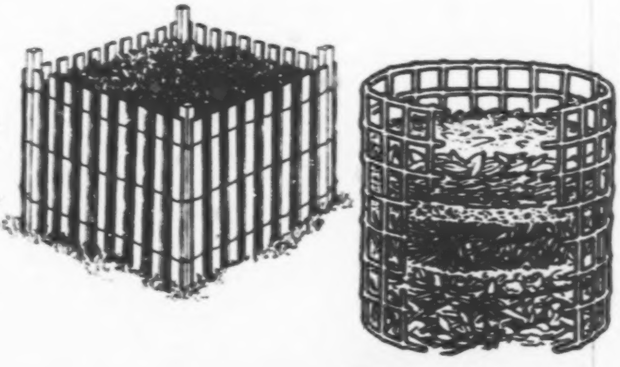
- Fill a plastic bag with some "once living" materials (e.g., cut fruit, grass clippings, moist bread) and hang the bag on the bulletin board with a sign reading "What do you think is happening in this bag?" Encourage students to observe and to make and explain predictions.
- Have students generate a list of things that they think will and will not decompose. To test predictions, create mini-decomposition chambers (e.g., sealed plastic bags or clear plastic shoeboxes) to leave in the classroom or bury outside. Students may want to experiment by providing air holes, blowing in air, or adding soil to some containers. Have them observe containers regularly, or dig them up after a month and examine the contents. (See the activity "FungusAmongus" on pages 210-213 in *GrowLab: Activities for Growing Minds* for further ideas.)
- Challenge students to work outdoors in small groups to identify examples of decomposition in action. Have them describe what they observe that leads them to think decomposition is occurring.

Cultivating Compost

When constructing and maintaining an outdoor compost pile, consider organizing cooperative student groups to rotate through the necessary tasks. As your students decide how to construct and care for your compost pile, they should begin to understand that they are providing the basic conditions that all living things—humans *and* decomposers—need to thrive: water, air, and nutrients.

Building the Pile

You can either build a freestanding pile or create an aerated enclosure using chicken wire, snow fence, wooden pallets, or lumber. To maintain enough heat in the center for rapid decomposition, make the pile at least one cubic meter. Some people build two piles, one for active compost and the other as a holding area for new materials. If you're concerned about animal pests or odors, you can purchase a ready-made, enclosed compost system, but properly aerated compost piles free of meat scraps and other animal products shouldn't have those problems.



To create an environment that encourages efficient decomposition, your compost pile should contain a mixture of dry (high carbon) materials, fresh (high nitrogen) materials, soil, air, and water. Microorganisms digest carbon as an energy source and take in nitrogen to make proteins. The smaller the materials, the more surface area is exposed and the more rapidly they will break down. Examples of high carbon and high nitrogen materials follow.

Dry Matter (high carbon)	Fresh Matter (high nitrogen)
hay	lawn clippings
straw	vegetable scraps
dried leaves	green garden debris
dried grass	cow manure
small branches	horse manure

Never include greasy foods; human, dog, or cat feces; meat; bones; or toxic materials. Also avoid adding noxious weeds or diseased plants (although a well-heated compost pile will kill many diseases and weeds).

Other additives sometimes recommended for compost piles are: layers of garden soil (to add additional decomposers), nitrogen fertilizer (if the pile has an abundance of dry materials), and compost inoculants or activators (see "Research Challenge," page 8).

Compost is most efficiently made by "aerobic" decomposers that require oxygen. If your pile is too dense or wet, thus poorly aerated, "anaerobic" decomposers will create a foul-smelling mixture. To keep a pile well aerated, place a dry, airy layer at the bottom, and periodically mix in coarse materials like hay. But be sure to water it occasionally: a compost pile should be kept about as moist as a wrung-out sponge.

Maintaining the Pile

During the first few weeks of composting, the center of an active pile may reach about 140° F. The heat produced as decomposition occurs further speeds up the process. Students may be surprised after feeling and measuring the temperature in the center of the pile. Ask them what analogies they can draw to human food consumption.

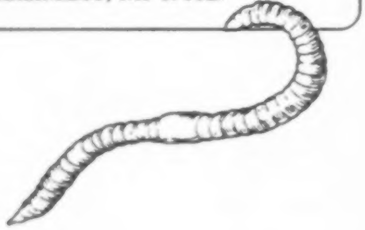
Although a pile will eventually compost if left alone, you can drastically increase the rate at which materials compost by turning the pile inside out. By turning the pile, you aerate and mix the materials so they all benefit from the rapid decomposition that takes place in the hot center. A pile with the right balance of materials and moisture, if turned every day, can completely compost in just a few weeks. A pile left to sit without turning could take

(continued on next page)

Worms Eat Our Lunch

"Our previous lunchroom staff said there's no way the kids will have the patience to sort trash," said Louann Talbert of Laytonville, CA. "But now students not only sort their lunches and other school trash, they carefully weigh and chart it, then add materials to student-built worm beds.

If you'd like to explore composting with worms, refer to the activity and resources listed in "Getting Hooked on Worms," pages 214-221 in *GrowLab: Activities for Growing Minds*. For information and details on worm composting systems, worms, and an activity guide, *Worms Eat Our Garbage: Classroom Activities for a Better Environment*, write to: Flower Press, 10332 Shaver Rd., Kalamazoo, MI 49002.



Rottin' Lessons

While your compost is "cooking," don't just sit and wait—your compost pile is a living laboratory and can be a centerpiece for studies across the curriculum. Consider having students conduct some of the following activities and brainstorm more of their own.

- Regularly measure and chart the temperature and dimensions of the pile over time.
- Draw or build a model of the layers or components in your pile. Describe how they change. Which original ingredients can be identified over time?
- Examine the different compost components under a microscope. Draw, describe, and try to identify them.
- Sort and classify organic materials outdoors as either dry (high carbon) or fresh (high nitrogen). Discuss how you made decisions about how to classify them.
- Based on what you've learned about decomposition and composting, draw a diagram to illustrate how an apple core could become part of a tomato and then part of you.
- Calculate the proportion of school lunch trash that could potentially be composted. Teach other students how to sort school lunch trash into compostable and non-compostable materials.
- Conduct a survey to determine what percentage of student families and teachers compost at home.
- Become compost "experts" and develop a newsletter or presentation to help teach others.
- Find out what happens with grass clippings, leaves, and other yard wastes collected in your town or city.
- Discuss this quote by Loren Eisley: "Nature has no interest in the preservation of her dead; her purpose is to start their elements upon the eternal road to life once more."

(continued from page 7)

many months. Turning the pile even once or twice will greatly decrease the time it takes to finish.

Compost is finished when it cools off and decreases to about a third of its original volume. It should be dark brown, soil-like, and have an earthy smell. You can use it in your outdoor garden or flower beds, where it will attract earthworms, help improve soil structure, and slowly release nutrients. You can also add compost to your indoor potting mix. Try experimenting with different proportions. (More than one third by volume of compost in potting mix may be too strong for tender seedlings.)

Composting Help

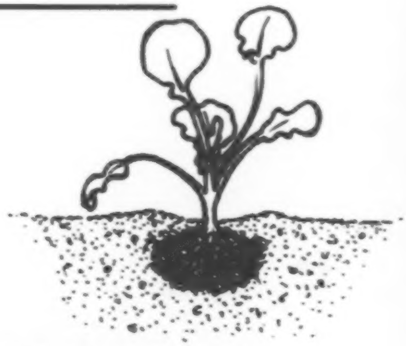
Are you inspired to try a composting project with your students, on a small scale or a schoolwide basis, but need further written materials, technical advice, or other support? With increased national attention to recycling, there are more and more resources available locally. Start by checking with your local Cooperative Extension Service or statewide recycling networks. In some areas, Cooperative Extension has even started Master Composter programs to train community volunteers to help others.

Research Challenge: Are Bacterial Boosters Better?

A number of companies have products that they claim will speed up the composting process either by improving conditions for decomposers or by actually providing the right types of decomposers to do the job quickly and efficiently. We've often wondered just how well these types of products work. Will a pile with a compost activator make compost more quickly or effectively than a pile without any? To engage your students in some "real life" research, Necessary Trading Company has offered to send a container of Compost BioActivator "with more than one billion hard-working microbes per gram" to 200 classrooms interested in exploring this question. In return, Necessary would like to hear about your results.

To order a free unit of Compost BioActivator, send your request to: GrowLab BioActivated Compost Project, Necessary Trading Company, One Nature's Way, New Castle, VA 24127-0305.

Green Tips



Move 'Em Out—Transplanting Hints

If you're gardening both in and out of the classroom, it's nearing time to transplant carefully tended classroom plants to outdoor gardens and flower beds. To help your transplants make a successful transition, consider the following tips:

- Challenge students to find out the average last frost date in your area (e.g., ask gardeners or contact the weather service). Check seed packages or catalogs to determine which seedlings can go out before the last frost date and which must wait.
- A week or so before transplanting, "harden off" seedlings by setting them outside for progressively longer periods each day to get them accustomed to harsher outdoor conditions. Start with a few hours and increase to a full day.
- Try to transplant on a cloudy or drizzly day to slow water loss from newly transplanted seedlings.
- To protect roots, water the plants before transplanting and keep as much soil as possible with the roots when removing the plants from their containers.
- Remove seedlings from containers carefully, making sure not to bend the stems.
- Make the transplant holes larger than the seedling rootball. Mix in compost or well rotted manure if available.
- Plant seedlings at about the same depth as they were in the containers, press the soil gently around the plant, and then water them well.

Finding Growing Partners

> *"It's been wonderful having the Master Gardener's support. I had never done classroom gardening before. I've learned so much from her, and we're able to combine my teaching strategies with her horticultural knowledge to produce some really nice projects."*
>
> Nancy Hall, teacher, Suffolk County, NY

Throughout the country, teachers are finding help for their growing efforts from a wide range of individual, organizational, and business "partners" who support garden-based learning. Partners' support ranges from donating seeds and supplies to providing GrowLab units, teacher workshops, and initiating classroom projects.

Classroom gardening partnership possibilities abound. If you would like help getting equipment, supplies, or technical support for starting a GrowLab Program, or for enriching your existing program, consider approaching the following groups in your area:

Cooperative Extension

The Cooperative Extension Service operates offices in nearly every county in the country, and offers a wealth of written horticultural information and advice. Extension 4-H leaders and other staff have been among the most active GrowLab Partners. Many Extension offices also have Master Gardener programs to train community members in horticulture. These Master Gardeners, in turn, are required to use their new horticultural skills volunteering in the community, and many do so in the schools.

Garden/Horticultural Clubs

Local garden clubs may be willing to provide funds for purchasing indoor gardens or materials, conduct special classroom projects, or provide technical support. Consider appealing to a local group to "adopt" your classroom. While you probably won't find them listed in the phone book, try asking at garden centers, Cooperative Extension, or other horticultural organizations for contacts your area.

Conservation Districts

Every state in the country has regional conservation districts whose role includes promoting conservation education. Contact your local Conservation District education staff either by calling the State Department of Agriculture or by looking under Conservation District or Soil and Water Conservation District in your phone book.

Botanical Gardens, Museums, Environmental Centers

Many of these organizations have rich educational programs, materials, and staff who can support your growing efforts. Check with these groups in your area to find out what garden-based educational materials they have, and to let them know about the GrowLab Program.

Parent/Teacher Organizations

Don't overlook your Parent/Teacher Organization's vital link to the classroom. Most school PTO's are committed to raising money to support school programs. PTO's are often eager to support innovative programs and to find projects in which to involve parent volunteers.

Local Businesses (nurseries, garden centers, hardware stores, etc.)

Don't be shy about approaching local businesses to donate materials or volunteer time in your school gardening program. Contributing to local education by supporting your "growing efforts" can be a good community service, an investment in future consumers, and an effective advertisement.

Large local businesses may offer grants to teachers for special educational programs or materials. Some have established business-school partnerships in which employees volunteer time in classrooms. Contact the community relations office to find out what types of educational support are available.

Tips for Approaching Partners

- Describe or have your students write letters describing your growing project or vision. Be sure to highlight what the students will gain from the experience.
- Have a ready list of supplies you'll need for the project.
- Find out about the organization's existing educational programs.
- Consider inviting potential partners to school to lead an activity or presentation, help brainstorm gardening projects, attend a "salad party," or conduct a teacher workshop.
- Share copies of this newsletter, the GrowLab brochure, and our introductory video with potential partners. Have them contact us for information on our GrowLab Partner resources and services.

Are You a GrowLab Partner?

Are you promoting garden-based learning or directly helping classroom teachers use plants to help young minds grow? Beginning with the fall 1993 issue of *Growing Ideas*, we will publish a *Growing Partnerships Update* as a resource for those who are helping classroom teachers implement GrowLab Programs. It will include highlights of successful partnerships, samples of training and workshop materials, funding suggestions, and resource listings.

If you would like to receive the *Growing Partnerships Update* with your next issue of *Growing Ideas*, indicate so on the response form on page 12.

(Video Visits, continued from page 4)

For Further Help

If you'd like to start by trading videos with me, send one of yours or send a postcard and ask me to send one for your students to respond to. I have a children's garden now at Pillsbury School in Minneapolis, and if I move next year, there will be a children's garden wherever I'm teaching. If you have questions about producing a gardening video or dealing with the challenges of international exchanges (e.g., language differences or tape conversions), send your specific questions with a stamped, self-addressed envelope to: **Larry [illegible]son, 315 Georgia Ave. North, [illegible]polis, MN 55427.**

(Garden Jigsaw, continued from page 5)

3. Materials monitor gets folder/information and returns to team.

4. Captain reads the instructions orally.

5. Team discusses what each member will do and what materials are needed.

6. Materials monitor gets the materials and work begins.

7. When each team's task is complete (after a set time allotment), team takes a few minutes to discuss how they will "teach" the rest of the class what they've learned by answering questions on the Q-Card.

8. Finally, teams collaboratively complete a feedback sheet and/or discuss how they worked together to become experts and solve problems. They discuss such questions as: What was different about working as a team as opposed to individually? How did it feel to have the different team roles? What did our team do well? What could we have done better?

Ask Three Before Me

To encourage discussion and problem solving and to free up your own time, consider requiring students to follow the "ask 3 before me" rule: Before coming to the teacher with a question, a student must first try to answer the question by consulting and discussing it with three other students.

Resources

In addition to the resources listed here, you'll find free and inexpensive resources mentioned in several articles in this issue. Please let us know if you've discovered sources of educational supplies or information that could enrich [illegible] teachers' growing experiences.

Grant-Writing Help

Teachers across the country have successfully funded classroom GrowLabs and other gardening supplies with Eisenhower math and science funds, district minigrants, local foundation grants, and other sources of funds. Now we've collected excerpts from these grants to help you successfully write a grant to fund a classroom GrowLab Program.

To request "How to Fund a Classroom GrowLab," send a stamped, self-addressed envelope to GrowLab Grants, National Gardening Association, 180 Flynn Ave., Burlington, VT 05401.

Children's Gardening Symposium

"Children, Plants and Gardens: Educational Opportunities," a national symposium scheduled for August 12-14 in Washington, DC, is being sponsored by the American Horticultural Society in collaboration with the National Gardening Association and other educational organizations. Presentations and workshops from educators, horticulturists, landscape architects, and community youth leaders will cover such topics as garden-based environmental education and how to obtain grants, donations, and community support for children's gardening programs. **For conference information, call toll free, 1-800-777-7931.**

Seed Collections

Kathy Wildman, a nursery owner from Sunbury, OH, is again offering *Growing Ideas* readers, for a minimal fee, collections of seeds donated by the Livingston Seed Company in Ohio. Each collection below contains at least 20 seed packets.

FLOWER GARDEN. A set of mixed flowers, including ones for drying.

HERBS AND EDIBLE FLOWERS. Includes savory, parsley, oregano, dill, nasturtiums, basil, and more.

VEGETABLE GARDEN. A potpourri of favorite vegetables.

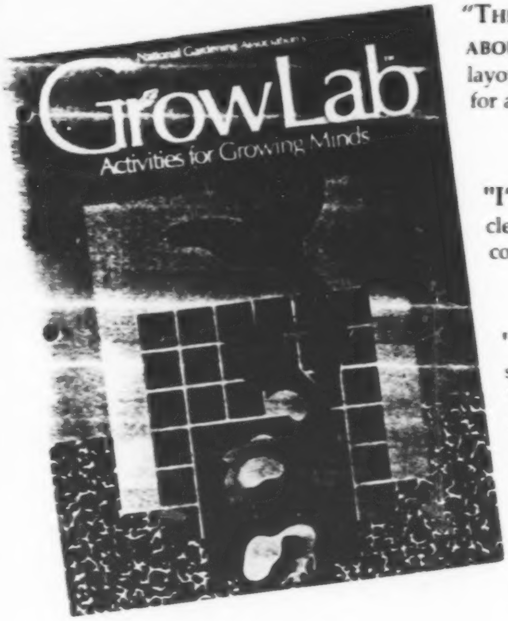
BUTTERFLY GARDEN. Contains seeds for both nectar and host plants for butterfly gardens.

To Order Seed Collections...

Send a list of the packets you want and a check (to cover postage and handling) for $5 for the first collection (20 packets) and $2.50 for each additional collection to: **Kathy Wildman, 3977 Condit Rd., Sunbury, OH 43074. Phone: (614) 965-2133.**

If You're Using Plants to Promote Learning. . .

...we want to send you *GrowLab:Activities for Growing Minds* free for 30 days. We feel confident that you will find it an indispensable resource for hands-on activities that inspire conceptual learning, problem solving and enthusiasm. Here's what your colleagues say about *Activities for Growing Minds:*



"THE ACTIVITIES ARE SO WELL EXPLAINED, THAT THERE'S NEVER A QUESTION ABOUT WHAT TO DO AND HOW. The time, materials, objectives and the entire layout make them easy to follow. The background information is thorough enough for any teacher to feel comfortable with the concepts."

—Deborah Hesselberth, Extension Agent, Rockford, IL

"I'VE BEEN VERY PLEASED WITH ALL THE ACTIVITIES I'VE USED. They're clearly explained, discovery oriented, and help me apply some of the standard concepts and skills in exciting new ways."

—Marla McAfee, resource teacher, Ft. Wayne, IN

"I EXTENSIVELY USE REPRODUCIBLES SUCH AS THE PLANT JOURNAL for students' ongoing plant observations. Activities like "Yo Seeds, Wake Up," "Lettuce Be Different," and many others fit in beautifully with our district's hands-on science program, and they're very educator friendly."

—Pam Fox, 3rd grade teacher, Frederick, CO

"EACH ACTIVITY PROVIDES A GOOD SEQUENCE SO I CAN START WITH BEGINNING CONCEPTS and run through a complete learning cycle. The materials lists are complete, the extension ideas compelling, and activities can be easily adapted for different durations and skill levels."

—Jeff Isham, elementary teacher, Moretown, VT

"THE EXERCISES REALLY GET KIDS THINKING and realizing that they can think through questions and challenges, come up with answers, and believe in their ability to solve problems."

—Karla Drover, 2nd grade teacher, Groveton, TX

☐ **Yes. Please send me *GrowLab: Activities for Growing Minds* free for 30 days.** I will either keep it and send $19.95 plus $3.00 for postage and handling, or I will return it in 30 days without further obligation.

Name ______________________________

School/Organization ______________________________

Street Address ______________________________

City ______________ State ______ Zip ______________

Phone ______________ Grade ______________

Return to: National Gardening Association, Dept. GR2, 180 Flynn Avenue, Burlington, VT 05401. FAX: (802) 863-5962.

To continue receiving *Growing Ideas,* mail this form today.

☐ Please begin/continue my **free subscription** to *Growing Ideas.*

☐ Send me a **brochure** on the GrowLab Program and instructional resources.

☐ Sign me up for the 1993/94 **Growing Ideas Exchange** as described on page 1.

☐ Send me your **Growing Partnerships Update** as described on page 9.

➡ **In the space below, please describe some of the activities and strategies you've used to integrate plants into your curriculum. (We may call you for more details as we plan future *Growing Ideas* articles.)**

Name ______________________ Title ________________ Grade ______

School/Organization ____________________ Street ____________________

City ________________ State ______ Zip ______ Phone ________________

Return to: Editor, Growing Ideas, National Gardening Association, 180 Flynn Avenue, Burlington, VT 05401.

Growing Ideas

A Journal of Garden-Based Learning
National Gardening Association
180 Flynn Avenue
Burlington, Vermont 05401

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A JOURNAL OF GARDEN-BASED LEARNING

Growing Ideas

Published by the National Gardening Association

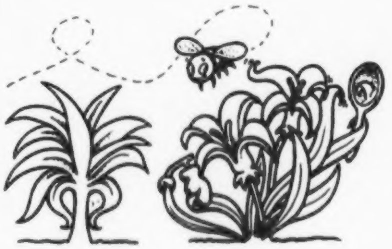
Volume 4, Number 3, September 1993

Petal Attraction

Weaving Wildflower Lessons

"The biggest thrill for my kids was noticing the constant changes from month to month in colors, textures, and insect life as different flowers bloomed in our wildflower patch," reports Wilmington, DE, teacher Sandy Thurston. Each of Sandy's learning-disabled students observed and sorted the seeds in a pinch of a wildflower seed mixture, calculated the percentages of different types of seeds, then made predictions about how different seedlings would look once they grew, using catalogs and identification books as resources.

Some students took the wildflower seedlings home to transplant, while others moved theirs to a wildflower patch they'd prepared at the school. "The students were in charge of planting, weeding, cutting old flower heads, and reseeding empty areas," reports Sandy. Students worked together in groups, using identification books to identify the plants, so that they could pull out the weeds and leave the wildflowers. "This generated a discussion on what's a weed and what's a wildflower," said Sandy. "Students decided to define weeds as those plants growing where we didn't want them, but they did recognize that what might be a weed for us could be a wildflower to another person."



Each student chose their favorite plant, drew it, researched it, and many did art projects inspired by the shapes, colors, and textures in the patch. The project did wonders for their observation skills, Sandy reports. "Before the flowers emerged, students had to make very detailed observations of leaves, noticing shapes, hairiness, toothed edges, and other features. They were thrilled to begin to distinguish details where they first saw only a field of green leaves."

Why Wildflowers?

If you want to encourage children to develop a love and respect for nature, consider those hardy survivors growing right outside the door, in sidewalk cracks, roadside meadows, and vacant lots. A transforming patch of wildflowers can help students learn firsthand about adaptations—for seed germination, pollination, dispersal—that enable plants to survive in their environments. Students can begin to understand the role of wild plants in preventing erosion and providing oxygen, food, and protection for insects, birds and other ani-

(continued on page 6)

Are You a GrowLab Partner?

If you're promoting garden-based learning or helping classroom teachers use plants to help young minds grow, we would like to send your our *Growing Partnerships Update*. The update, beginning in January 1994, will include highlights of successful partnerships, samples of workshop materials, funding suggestions, and resource listings.

If you would like to receive the *Growing Partnerships Update* or have information from your program to contribute, indicate so on the survey on page 11.

GrowLab Presentation Help

If you'd like to share your growing experiences with colleagues through informal school or district presentations, inservice workshops, or at local, state, or national professional conferences, we'd be happy to help you. Contact the Education Department at NGA for a free GrowLab video and presentation packet as well as brochures, newsletters, and other handouts. A limited number of honoraria (up to $50) are available to help cover expenses for state, regional or national conference presentations.

This project was supported, in part, by the
National Science Foundation
Opinions expressed are those of the authors
and not necessarily those of the Foundation

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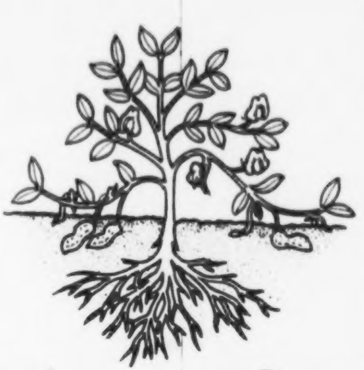
Exchange

Reaping Nutritional Resources

"Think about a plant food you eat that you might like to spend a long time investigating," Arlene Marturano directed her sixth graders in Columbia, SC. What followed was an intensive nutrition unit during which students immersed themselves in gathering free resource materials; learning about plant nutrition, histories, and uses; tasting a wide range of foods; and trying to cultivate food crops in the GrowLab.

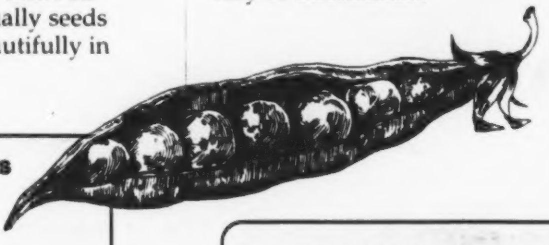
Part of each student's challenge was to contact at least one business or industry group to obtain nutritional, agricultural, or other types of information and materials on his or her chosen food. "I wanted students to discover that they can find out information in many different ways," reports Arlene. "They quickly learned how to communicate their needs and interests in writing and on the phone with someone new, and their motivation increased tremendously when they started to get a range of free materials in the mail."

Arlene's astute sleuths found food labels, local business contacts, and library books that yielded addresses or toll-free numbers. More than 100 industry and horticultural organizations and businesses responded to student requests with posters, videos, educational materials, recipes, nutritional information, and product samples on such foods as garlic, oils, cereals, peanuts, and cotton. "The North Carolina Sweet Potato Commission even responded to one student's request for information by sending a representative to speak with our class," notes Arlene. "And the students were surprised that lentils sent to us by the Lentil and Pea Commission were actually seeds and that they grew beautifully in the GrowLab."



Each student was challenged to follow a suggested research outline and discover a wide range of information, including how their crop is grown, harvested, processed, its nutritional value, and the ways in which it's used. Arlene encouraged students to try growing their crop in the classroom when possible, and the GrowLab soon sported peanuts, grains, oil sunflowers, and garlic. At an Earth Day booth on the Statehouse lawn, Arlene's students wrapped up the project by individually presenting puppet skits, jingles, and songs to sing the praises and tell the stories of their special foods.

Note: If you engage your students in uncovering sources of free information on plant foods (or if you do so yourself), be sure to review them with a critical eye. Because much of this information is tied to product promotions, it may promote specific brand name products or present an unbalanced perspective on a food or product. This can provide a good opportunity to teach your students to critically assess promotional materials and advertising techniques and to do further research to check the accuracy of information.



Sample Contacts for Free Educational Materials

- California Artichoke Board, 1-800-827-2783
- California Tomato, 1-800-827-0628
- Florida Dept. Citrus Sunkist Hotline, 1-800-248-7875
- General Mills-Cheerios, 1-800-247-4393 or 1-800-328-1144
- Georgia Peanut Commission, 1-800-346-4993
- Dry Pea and Lentil Commission, 208-882-3023
- McCormick Spices, 1-800-632-5847

Growing Ideas is published three times a year by the Education Programs Department of the National Gardening Association. *Growing Ideas* provides instructional ideas, horticultural information and a forum for exchange among teachers using classroom gardening to stimulate learning.

For a complimentary issue of *Growing Ideas*, write to: *Growing Ideas*, National Gardening Association, 180 Flynn Avenue, Burlington, Vermont 05401.

Editor: Eve Pranis

Building Confidence and GrowLabs

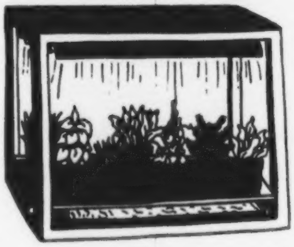
"My developmentally handicapped fourth through sixth graders were upset when we were asked to give the top of our double GrowLab unit to another class to use," notes Jack Mizenko in Cleveland, OH. "But that loss created another opportunity—we decided to build another GrowLab ourselves!"

The students first practiced sawing and using tools in rotating cooperative groups, then each student had the opportunity to measure, saw, drill, nail, and screw. By the end of the day, reports Jack, they had a finished GrowLab. "The students were pleased with themselves and their confidence *really* soared when two teachers asked if we could build one for their classrooms."

The "Meadowlawn Flyers," Kathy Wobser's special education class's 4-H club in Sandusky, OH, also greeted the challenge of building a GrowLab with enthusiasm. After sending letters to local companies soliciting donations, the class gathered the necessary electrical materials, wood, and other supplies to build a GrowLab.

Denny Weilnau, a 4-H agent with Cooperative Extension, worked in the classroom with students for two days to measure, saw, sand, and complete the indoor garden. "These special education kids were thrilled with the unprecedented attention and praise they got from other teachers and students. Our GrowLab was one of the nicest displays at our school projects fair."

While some teachers identify school or grant money for ready-made GrowLabs, others have found that building GrowLabs can both save money and provide a valuable experience for building self esteem and skills. You can find complete plans for building your own wooden GrowLab in *GrowLab: A Complete Guide to Gardening in the Classroom*. Char Bezanson, a Biology Instructor at St. Olaf College in Northfield, MN, has drafted a set of plans (modified from a design by Joe Premo and Phil Tennison of Minnesota) for a sturdy GrowLab made from PVC pipes.



For a copy of National Gardening Association's wooden GrowLab plans or Char's PVC pipe plans, send a check for $3 per set (to cover postage and handling) to: **GrowLab Plans, National Gardening Association, 180 Flynn Ave., Burlington, VT 05401.**

Happy Birthday, Peter Rabbit!

Inspired by images of clever Peter Rabbit enjoying the fruits of Farmer McGregor's labor, the kindergarteners in Bonnie Meyers's class in Bridgeton, NJ, raised their own GrowLab vegetable garden. The planting project was part of the class's celebration of the 100th anniversary of Beatrix Potter's first picture-letter, which was the basis for *The Tale of Peter Rabbit*.

While students watched and waited for their pots of lettuce, radishes, beans, and carrot tops to mature, they explored the produce section of a local supermarket, identifying vegetables and selecting those representing a range of plant parts. Back at school, they sorted and categorized the vegetables, drew pictures, then created a colorful salad. Once their homegrown vegetables were ready, they prepared and ate their own "birthday" salad under the watchful guidance of a framed picture of Peter Rabbit.

Thanks to Kate Beddingfield, science consultant in Bridgeton, NJ, for inspiring and reporting on this project.

Global Gardening Connections

News images of hunger and starvation in Somalia weighed on the minds of Leslie Erickson's first and second graders in St. Paul, MN. They discussed how people throughout history have creatively gathered, grown, and eaten a wide range of foods in order to survive. "When I told students that Native Americans had eaten cattail shoots and other plant parts, they said 'yuck,'" reports Leslie. "I reminded them that they, too, eat plant leaves, but they didn't believe me. It was a perfect opportunity to study and explore plant parts."

The students were intrigued by the idea of using their imaginations to discover new food sources, explains Leslie. One student brought in birdseed, which the class was amazed to see sprout and grow. This inspired them to try growing other unlikely things like dog food and carrot tops. "As some experiments grew and thrived and others just got soggy," says Leslie, "we discussed being thankful for our good growing conditions and abundant food system. The project inspired their genuine concern about global hunger and promoted a brainstorm of possible solutions to feeding people in other parts of the world."

Plants and People—How Are We Alike?

I'M HOT AND THIRSTY. I'M WILTING!
GET YOUR TENDRILS OFF ME
PHIL WON'T KEEP HIS ROOTS IN HIS POT
IF YOU HAVE ANY MORE WATER IT'LL GO RIGHT THROUGH YOU
DON'T MAKE ME COME BACK THERE AND REPOT YOU!

"While we were transplanting one day, my kids were amazed to see the plant roots emerging from the bottoms of the pots," reports Cleveland, OH, second grade teacher Katy McGinty. "One student quickly made the analogy to the way she feels when her clothes or shoes are too tight."

Drawing analogies and making comparisons between plants and themselves can help students personalize their understanding of certain basic needs, distinguish and appreciate the similarities and differences among living things, and may spark controversial questions that fuel further research or investigations. This type of exercise can also help you find out what students already know or have learned, and might highlight some misconceptions. By doing the same type of exercise at the beginning and end of the year, you can assess how your students' understanding changed.

Consider creating a class brainstorm chart called "Plants and People" with such headings as: How Are We Alike? How Are We Different? Questions We're Unsure of. Using the chart as a springboard, you might also use Venn diagrams to map those qualities unique to plants, those unique to humans, and those areas where there is overlap.

One group of young gardeners wrote to tell us about their inventive people/plant comparisons. They ranged from *"both plants and people can become wilted with too much sun,"* to *"some people (and plants) mature early and some are late bloomers"*!

While making comparisons, ask questions that encourage students to move toward increasing levels of detail. They might, for instance, suggest that both plants and people need water. You can then have them compare more specifically how both meet their needs for water.

A common misconception often revealed in this type of exercise is that both plants and people need to eat food. In reality, plants, through photosynthesis, are uniquely adapted to make their own food. What many call plant foods (fertilizers) are actually minerals and nutrients much like our vitamins and minerals. Bringing out students' conceptions in this area can lay the groundwork for an activity such as "Look Out for Leaves" or "Puzzled by Photosynthesis" (in *GrowLab: Activities for Growing Minds*) that stress a plant's ability to make food.

Students also may suggest questions or comparisons that have less obvious or more debatable answers. Do plants have feelings? Do they experience "pain"? Do they communicate? Some of these topics are still being debated and researched by the scientific community and may encourage further research or investigations in your class.

To expand and extend this type of activity, consider the following:

- Create pictures or essays titled: "What Plant I Am Most Like and Why."
- Write a first-person narrative from a plant perspective about the advantages, limitations, and unique possibilities of being a plant.
- Create a "family album" for a particular plant.
- Read seed packets to identify qualities that could describe both plants and people. Use the seed packets to create a personality for a main character in a story.

Inquiring Minds Want to Grow

Is Bigger *Really* Better?

"What makes plants grow best?" asked Kevin Hardy's fifth graders in Grand Junction, CO. While some students insisted that fertilizer made plants grow better, other more skeptical ones believed that fertilizer companies were "ripping off" gardeners and that plants "fed" only water would fair as well as those that were fertilized. The stage was set for inquiring minds to grow....

Kevin's students decided to test how different brands of fertilizer and plain water affected plant growth, and assuming "the bigger the better," chose height as the indicator of best growth. They graphed plant height and videotaped growth daily, running the camera for a count of ten for each plant, then editing the tape so they could watch each plant grow in succession.

"The plants given just plain water actually grew taller than the fertilized plants," says Kevin. "This surprised some students, so they did more research and discussed what factors other than height might indicate plant health. They realized that the number, size, and color of leaves might indicate plant health since leaves make food for the plant, and that thicker, shorter stalks might actually mean sturdier, more resilient plants."

Again observing the plants and videos, students carefully observed factors *other* than height, and recognized that the shorter fertilized plants, based on their new assumptions, were sturdier and healthier-looking. Over time, notes Kevin, students began to shift their ideas about bigger necessarily being better or healthier. "This investigation sparked a lot of discussion, caused students to revise their previous assumptions, and inspired more questions about plant needs."

Dry Pot Dilemma

Inquiry investigations need not be limited to upper elementary children, as demonstrated by Jackie Custer's kindergarteners in Cleveland, OH. When Jackie's students ran out of peat pots while planting tomato seeds, they decided to use plastic pots for some of their seedlings instead. A week later, students noticed that although seedlings had emerged in the plastic pots, there was no sign of life in the peat pots.

Concerned about the lack of growth, says Jackie, the class discussed what might be wrong and recorded all possible explanations on a chart. The students' hypotheses included:

- *Seeds were no good.*
- *Wrong amount of plant food.*
- *GrowLab light was needed for germination.*
- *Not enough or too much water misted on plants.*

To guide student thinking, Jackie challenged, "How might we use what we already know or gather new information to help us narrow down the problem?" The children first decided to compare the seed expiration date with the current date (with reading help from Jackie), and concluded that the seeds were still good. They next double-checked the fertilizer directions and determined that the correct amount had been used. In response to their hypothesis about light, Jackie told them that for these seeds, light is not required. That left the water question. Students recalled that all pots had been treated the same, but when they felt inside the pots to check moisture, they noticed that the soil in the peat pots was much drier than the soil in the plastic pots.

Students concluded that although they had been using the same amount of water, the peat pots must dry out faster than the plastic containers. To test their new hypothesis, they used watering cans instead of misters and soaked the capillary mat well before the weekend.

"The following Monday," reports Jackie, "the kids observed that plants in all of the pots were indeed growing and exclaimed 'We were right!' They were proud and thrilled that they had systematically solved the problem using thinking and science process skills. These kids have so few opportunities to think for themselves and work through a problem—I'm glad I didn't just give them the answer."

Guiding Growing Inquiry

"Growing" projects naturally inspire student questions that can lead to inquiry investigations. Although not everything can be learned through a hands-on, inquiry approach, investigations driven by student observations and questions help them gain the skills and confidence to tackle problems and construct their own understanding of the world. Keep alert for opportunities that help students view themselves as scientists in the process of learning. If you don't know an answer, consider saying, "I don't know—how might we find out?" If you do know the answer, you might still choose to let your students experiment to discover it for themselves. To encourage students to be inquirers, consider the following suggestions:

✦ Provide materials and challenges rich in potential for sparking curiosity and questions.

✦ Accept students' questions and ideas as starting points for investigations.

✦ Help students frame questions that can be "tested" with classroom experiments.

✦ Set an atmosphere that encourages risks and mistakes. "Messing about" is at the heart of true scientific exploration.

✦ Provide opportunities for students to work collaboratively to solve problems and discuss results.

✦ Ask open-ended questions that encourage students to draw on previous experiences, observe, reflect on investigations, and ask new questions.

✦ View yourself as a "guide on the side" facilitating student investigations rather than a "sage on the stage" leading and imparting all knowledge.

Use the enclosed survey to let us know how your students have used their questions as springboards for inquiry investigations. We'd like to share their experiences with other *Growing Ideas* readers.

(continued from page 1)

mals. You can inspire important language and history lessons by exploring how wildflowers got their common or Latin names, or by discovering their folklore and culinary and medicinal uses.

Seventh graders in Carolyn Burgess's Crozer, VA, class collected and identified wild seeds in the fall, used books and local resources to study their special germination needs, then used different techniques to try to simulate nature's conditions for sprouting seeds. "The experience of thinking about how seed needs are met in the wild, and trying to simulate what is invisibly accomplished in nature, has given them a much greater appreciation for native plants and the diversity of the natural world," reports Carolyn. "They no longer look at roadside plants as 'just weeds'."

A wildflower unit for your classroom can be simple or elaborate to fit your situation. It could range from observing and identifying wildflowers growing around the school or in nearby lots to collecting or obtaining seeds and trying to germinate them in the classroom. Or you might choose to establish a full-blown wildflower meadow.

You can purchase wildflower seeds individually or as mixtures, or collect seeds in fall and experiment with methods of germinating them...

Harvesting Wildflower Seeds

Since fall is when many wild plants release their seeds, it's a good time to explore wild plants' seed dispersal strategies, collect them for your classroom garden, and experiment with methods of inducing them to grow. You'll have the best chance of success if you harvest seeds when they're ripe. Most of the wild plant seeds you collect will be mature or ripe 4 to 6 weeks after they've flowered. Have your eagle-eyed scientists carefully observe flowers in your area, looking for a change in fruit color from green to brown or black and a sign that the typically dark, firm, and dry seeds are ready to disperse.

Never collect seeds of any plant that seems to be in short supply in a given area or that you know to be endangered. Leave plenty of seeds so that the plant can continue to produce new generations. If you're not planting seeds right away, dry them in an area with good circulation for a couple of weeks and store them in an airtight container in a refrigerator or other cool, dry place.

Coaxing Germination Indoors

Although they're billed as hardy survivors, wildflower seeds can be challenging to germinate in your seemingly cozy classroom setting. Most wildflowers from cold climates require a dormant period of cold winter-like temperatures followed by spring-like warmth to germinate. This adaptation prevents them from germinating in the fall when subsequent winter conditions would prevent their surviving.

Your students may want to experiment with some of the following seed treatments to encourage seeds from wild plants to germinate in the classroom:

Scarring. Some seeds with hard coats will germinate more successfully if you use a file or sandpaper to scar the seed coat, taking care not to go deeply enough to injure the embryo. Invite your students to examine why scarring aids germination by looking at a bean seed and noticing the tiny opening near the scar where it was attached to the pod. This is the micropyle through which water enters. Try painting over the micropyle on one seed with nail polish, leaving one seed alone, and scarring a third seed. Soak them all in water, make predictions about how they'll look in a day, then compare them.

Soaking in hot water. Some seeds with hard coats, such as lupines, do best when placed in boiling water and then left to soak in the cooling water overnight before planting.

Moist chilling or stratification. Many seeds dispersed in the fall have internal dormancy, requiring a period of cold before they'll germinate. Consider putting seeds in a bit of damp peat moss, vermiculite, sand or potting mix in a plastic bag or jar. Keep them in the refrigerator for 2 to 3 months before removing and planting.

Creating a Wildflower Patch

You don't need a large area to start a wildflower patch near your school. Consider starting small, perhaps around the flagpole or in a 6-foot strip near the school. Contact a local Cooperative Extension office, soil conservation service, nursery or garden center for help assessing your site, planning, and identifying and finding seeds for plants that would grow best in your area.

Have students take an inventory of the proposed wildflower area. What plants are already there? Are there any native plants or wildflowers you'd like to leave? What are the light and soil conditions? Find out which plants would grow best in your area. If you decide to plant a range of single species as opposed to a wildflower mixture, have students consider heights, colors, and bloom periods, and design a map to scale on graph paper. If you choose to plant a mixture, make sure all the flowers are appropriate to your region. Don't be surprised if not everything comes up the first year. Annual flowers will predominate the first year, followed in subsequent years by increasing numbers of perennials and, if poorly weeded, a succession of grasses and other weeds.

Wildflower meadows should typically be planted from seed during cool, wet fall conditions. Some plants will germinate right away and establish a root system before overwintering. Others requiring winter-like temperatures will germinate with spring warmth and rains. If you don't plant in the fall, you can sow seeds outdoors in the spring when you'll also be transplanting any wildflowers started in the classroom. (Seeds that need chilling should emerge the second year.)

Since there is so much to be said about cultivating wildflowers and limited room in *Growing Ideas*, we recommend finding written resources (see page 9) and local sources of support to guide your efforts. In the meantime, here are a few key planting tips.

Wildflower Wisdom—Planting Tips

- If possible, plant wildflower seed outdoors in the fall.
- Choose a wildflower mix or individual species appropriate for your area.
- Loosen soil and clear out weeds before planting.
- Scatter wildflower seeds according to the seeding rate on the package and rake them lightly. They should have good soil contact, but should not be buried deeply. You can mix them with sand for better distribution.
- Don't fertilize. (Most wildflowers are adapted to poor soils.)
- Don't expect everything to come up the first year.

One Person's Weed...

...is another's wildflower. A wildflower project can help your students discover that certain terms are relative and defined by circumstances. A weed, for example, is often defined as a plant that grows where you don't want it. But while black-eyed Susans may be a weed in my garden, they may be a star in your wildflower meadow. Typically, wildflowers are considered flowering plants, native to a particular region, that grow without intentional cultivation by humans. Many common wildflowers, however, were not native plants, but introduced intentionally or unintentionally from another area (e.g., Europe) and now exist successfully in the wild—some so successfully that they are considered invasive weeds. Plants grown as wildflowers in one area will not necesarily grow wild in other area. As your students explore wildflowers, have them consider in which contexts each flower might be considered a weed, wildflower, or native plant.

5 Easy Wildflowers

The following are a few wildflowers that are relatively easy to start from seed indoors and to transplant outdoors in the spring. Most should germinate in 2 or 3 weeks in a warm classroom. Although native to particular areas of the country, these plants can be grown successfully in most regions.

Common Name	Latin Name	Planting Tips
Tickseed	*Coreopsis lanceolata* (perennial) *Coreopsis tinctoria* (annual)	Sow seeds on surface (They need light.)
Black-Eyed Susan	*Rudbeckia hirta* (perennial)	Although seeds may germinate without it, try stratifying them (see pg. 6) for 3 to 4 weeks. Sow seeds 1/4" to 1/2" deep.
Indian Blanket	*Gaillardia pulchella* (annual)	Sow seeds 1/8" to 1/4" deep. No special treatment needed.
Columbine	*Aquilegia canadensis* (perennial)	Sow seeds on surface (They need light.) Stratify (see pg. 6) for 4 weeks. May not bloom until second year.
Purple Coneflower	*Echinacea purpurea* (perennial)	Sow seeds 1/4" deep. Try putting dry seeds in a plastic bag in the refrigerator for 3 to 4 weeks before sowing.

Wildflowers Across the Curriculum

A wildflower project offers a wide range of opportunities for tying in activities across the curriculum. Here are a few ideas to get you thinking....

- Observe and compare a given area of a wildflower patch with another type of ecosystem, for instance, a lawn or wooded area. Use data sheets to inventory and compare the different types and relationships of plant and animal life.
- Illustrate or take pictures or videos of a wildflower patch over time.
- Calculate the percentages of different types of plants in your own wildflower patch or a local meadow.
- Design a wildflower scavenger hunt, challenging pairs of students to locate such items as leaves or flowers with specific characteristics (e.g., toothed edges, fuzziness, nectar guides) or plants that attract certain types of pollinators.
- Grow and/or observe and compare selected wildflowers with their cultivated cousins, for instance, Queen Anne's lace and carrots.
- Conduct the activity "Go Seeds Go" from *Activities for Growing Minds* to explore seed dispersal. Then after collecting or observing wildflower seeds, try to identify how each is dispersed (by wind, water, animals, explosion, etc.).
- After reading the quote below, discuss whether and how people today are "seed movers":

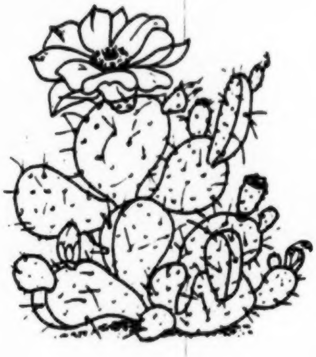
> "Wildflowers are survivors. Many are native to this land; many, like us, are immigrants who sent their descendants across the nation on the wheels of covered wagons, on the hooves of horses, or in the pockets of frontier children."
>
> —Lady Bird Johnson

- Find out which wildflowers are endangered in your area and design and create a slogan, logo or T-shirt to let people know about protecting them.
- Immerse yourselves in wildflower poetry and prose. Find references in fiction books or create haiku or other poetry forms with a wildflower focus.
- Create a wildflower book for your state. (Two of Susan Cox's students in Wilmington, DE, wrote and illustrated an A-to-Z *Wild About Wildflowers* book featuring a child's name, state location, and wildflower to coincide with every letter of the alphabet. Example: *Michelle saw a Monarch butterfly sitting on some Milkweed which was growing in a meadow in Milford.)*
- Read Ralph Waldo Emerson's quote: "Many eyes go through the meadow, but few see the flowers in it." Have students discuss or write about multiple meanings of the quote, and about how their own perceptions of wildflowers have changed as a result of your project.

Wildflower Folklore

Did you know that columbine was once used as a tonic to revive the strength of lions in the spring? Or that coreopsis seeds (from *koris*, meaning "bedbug" and *opsis*, meaning "looks like") were believed to repel bugs and were used to stuff mattresses? Wildflowers and native plants have played an important role in people's lives throughout the centuries, providing medicine, food, inspiration for art and writing, and beauty to lift the spirits. It can be fascinating to study their folklore, secrets behind their Latin and common names, and their virtues and uses. The more common the wildflower or weed, the richer its history, number of uses, and legends seem to be. Consider the following activities and invent some of your own:

- Have students make creative guesses, then research to discover what the common and Latin names of wildflowers tell us about their structures, uses or cultural/historical significance.
- Read: Tomie dePaola's books, *The Legend of the Bluebonnett* and *The Legend of the Indian Paintbrush.* Then have students choose wildflowers and develop their own legends based on the names.



- Research the historical medicinal uses of wild plants, and find out how wild plants are used today for medicinal purposes.
- Discover and map out the native regions of wildflowers found in a mixture or those found in your area.
- Find out about currently used edible wild plants and try some wild plant recipes.

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Wildflower Resource Materials

Petal Attraction—The Pollination Game

Even though they're stuck in place, plants have evolved features, embodied in their flowers, that enable them to "move" in search of a mate. Special adaptations, including flower color and shape, scent, and the production of nectar help individual species "compete" for certain pollinators.

Consider reviewing the background information on pollinators and flowers in the National Wildflower Research Center's article, "The Pollination Game" (part of NWRC's *Growing Ideas* packet listed on this page). Then observe a range of flowers in the wild, describe and compare features that might attract pollinators, and predict what types of pollinators might be attracted to each flower. Observe pollinators in action to see if your predictions were correct. (The activities, "Flowers Up Close" and "Petal Attraction" from *Activities for Growing Minds* will also help students better understand the role of flowers in ensuring pollination.)

Can Wildflowers Be Tamed? You Tell Us!

Although we know that you can start many wildflowers from seed in GrowLabs or on windowsills, none of our experts are sure which ones can actually be grown to maturity under lights indoors. Is it possible, we wonder, for classes without a good outdoor growing location to get wildflowers to bloom in the classroom? Why not experiment and find out, then let us know so we can publish your results in a future issue of *Growing Ideas?*

Growing Ideas Wildflower Packet

The National Wildflower Research Center has created a special packet of information for *Growing Ideas* readers interested in using wildflowers to help young minds grow. The packet contains lists of recommended wildflower species and sources for your state, information on collecting seeds and starting a wildflower meadow or wildlife habitat, classroom activities such as collecting and pressing wildflowers, an educational bibliography, and a special article on pollinators and wildflowers.

To order, request the "Growing Ideas Wildflower Packet" and send $8 to cover postage and handling to: Clearinghouse, National Wildflower Research Center, 2600 FM 973 North, Austin, TX 78725-4201.

Other useful resources include:

- *Wildflower Folklore* by Laura C. Martin, 1984. Fast and McMillan Publishers, Inc., Charlotte, NC.
- *A Garden of Wildflowers* by Henry W. Art, 1986. Storey Communications, Inc. Pownal, VT.
- *The Wildflower Meadow Book* by Laura C. Martin, 1990. The Globe Pequot Press, Chester, CT.
- Wildflower identification guides. Many can be found in bookstores and libraries.

Free Black-Eyed Susans (and germination challenge!)

Wildseed Farms, Inc. has offered to send a free packet of black-eyed Susan seeds to classes interested in getting started with wildflowers. We know that black-eyed Susans are easy to grow from seed indoors, will transplant outdoors well, and will grow in almost all parts of the country. But we are in a quandary about their preferred germination conditions. Some resource books say that they must be stratified (see page 6) for 3 months before they'll sprout in a warm setting, while other books say they do not require chilling to germinate. Challenge your students to experiment and tell us which conditions will induce these wildflowers to sprout. Send us your feedback and we'll publish the collective results in a future issue of *Growing Ideas.*

To order a free packet of black-eyed Susans and an educational wildflower catalog, send your request along with a stamped, self-addressed envelope to: Wildseed Farms, Inc., Dept. NGL, P.O. Box 308, Eagle Lake, TX 77434.

Wildflower Seed Collections

Kathy Wildman, a nursery owner from Sunbury, OH, would like to offer *Growing Ideas* readers collections of wildflower seeds donated by the Livingston Seed Co. in Ohio. Each collection contains at least 20 packets including wildflower seed mixtures and single species.

To order the Wildflower Seed Collection, send $5 to cover postage and handling (add $2.50 for each additional collection) to: Kathy Wildman, 3977 Condit Rd., Sunbury, OH 43074. Phone: 614-965-2133.

Resources

Youth Gardening Grants Available

National Gardening Association's 1994 Youth Garden Grant applications are now available to schools and other youth-serving groups with outdoor gardening programs. If your outdoor gardening program involves 15 or more young people between three and 18 years, you are eligible to apply for either a food gardening or beautification award consisting of hundreds of dollars' worth of tools, seeds, garden products, and educational materials. This year *everyone* wins—even those applicants not awarded one of the 200 grants will receive seeds and educational materials to inspire further sowing and growing.

Last year's grant-winning programs range from an intergenerational gardening project in which seniors and students work shoulder to shoulder to grow fresh vegetables and conduct environmental explorations, to an elementary school project focused on learning about history and geography through raising and studying foods of other cultures. What all winners have in common is strong leadership, community support, and a commitment to using gardens to stimulate curiosity, hands-on learning, and environmental awareness.

To receive a 1994 grant application, call or write: Garden Grants, National Gardening Association, 180 Flynn Ave., Burlington, VT 05401. 802-863-1308. The deadline for completed applications is November 1, 1993.

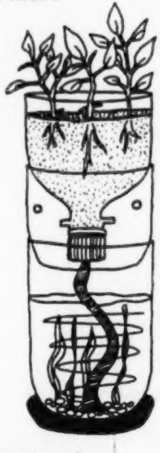
Getting Hooked on Worms

For those who were inspired by our feature article in the April 1992 *Growing Ideas* or the worm project in *Activities for Growing Minds*, or were otherwise intrigued to get hooked on worms, we recommend Mary Appelhof's *Worms Eat Our Garbage: Classroom Activities for a Better Environment*. The more than 150 classroom activities, designed for fourth through eighth grade classrooms, inspire observational and problem-solving explorations that are non-harmful to the worms being studied. Clever "wormformation" boxes contain nitty-gritty biological background information which, combined with investigative activities—worm composting, worm food preferences and responses, how plants respond to worm castings—help students understand important life science concepts.

To order *Worms Eat Our Garbage: Classroom Activities for a Better Environment*, send $19.95 plus $2 shipping with your request to: Flowerfield Enterprises, 10332 Shaver Rd., Kalamazoo, MI 49002, or call 616-327-0108.

Bottled Biology

A newly released book from the folks who created FastPlants, the 127-page book *Bottle Biology* by Paul Williams is rich with ideas to help classroom teachers use plastic soda bottles, film canisters, and other recyclable materials to inspire creative environmental-science activities. Detailed instructions guide the reader in how to use readily available materials to build such learning tools as decomposition, worm, and soil columns, and mini-models of land/water ecosystems.



To order (for $15.95 plus $3 postage) or for more information on *Bottle Biology*, call Kendall/Hunt Publishing Co. at 1-800-228-0810.

The Compost Challenge Continues

In the April 1993 issue of *Growing Ideas*, we featured a challenge to classrooms interested in exploring the claims of companies promoting "compost activators." Will a compost pile with a bacterial compost activator *really* make compost more quickly or effectively than a pile without any? To inspire "real life" research, the Necessary Trading Company is again offering to send a container of Compost BioActivator "with more than one billion hard-working microbes per gram" to classrooms interested in experimenting with this question. In return, the folks at Necessary Trading Company would like to hear about your results.

To order a free unit of Compost BioActivator, send your request to: GrowLab BioActivated Compost Project, Necessary Trading Company, One Nature's Way, New Castle, VA 24127-0305.

To continue to receive free issues of *Growing Ideas*, return this form:

Name ______________________ Title ______________________ Grade __________

School/Organization ______________________ Street ______________________

City ______________________ State ________ Zip ________ Phone ______________________

☐ Please begin / continue my free subscription to *Growing Ideas.*

☐ Send me a brochure and price list for the GrowLab Program and instructional resources.

☐ Send me the Growing Partnership Update as described on page 1.

☐ Sign me up for the 1993/94 *Growing Ideas Exchange*. (You must fill out the reverse side of this survey to be included.)

1. What kinds of inquiry-based investigations have your students conducted in their indoor garden?

2. How did you hear about our GrowLab Indoor Gardening Program?

☐ eductors' convention (which one?) ______________________

☐ advertisement in ______________________

☐ other ______________________

☐ other teachers or administrators

☐ article in ______________________

3. Please list the names and school addresses of other educators who might like to receive information on plant- and garden-based educational resources (attach another sheet, if necessary.)

If you're using plants to promote learning...

...we want to send you ***GrowLab: Activities for Growing Minds*** free for 30 days. We feel confident that you'll find it an indispensable resource for hands-on activities that inspire conceptual learning, problem solving, and enthusiasm.

☐ Yes. Please send me *GrowLab: Activities for Growing Minds* free for 30 days. I will either keep it and send $24.95 plus $3 for postage and handling, or I will return it in 30 days without further obligation.

Name ______________________________________

School/Organization ______________________________________

Street Address ______________________________________

City ______________________ State ____________ Zip ______________

Phone ______________________ Grade ______________________

Return to: National Gardening Association, Dept. GR3, 180 Flynn Avenue, Burlington, VT 05401. Phone: 802- 863-1308 FAX: 802-863-5962

1993/94 *Growing Ideas Exchange* Signup

What's happening in other growing classrooms around the country? Why not find pen pals or consider sharing special seeds, student-made videos, or experimental data with gardening classrooms nationwide? **By completing and returning this form (and the survey on the reverse side) by October 15, you'll be listed in and will receive a copy of the 1993/94 *Growing Ideas Exchange*.**

1. Fill out the reverse side of this form.

2. In 50 words or less, tell others about your classroom's growing activities and projects. (Are you experimenting with seeds from space? raising a GrowLab salad garden? engaged in a thematic herb project?)

3. Briefly describe what you would like to exchange with other classrooms. (e.g., pen pals, special regional seeds, experimental data, classroom videos.) Be specific if possible.

Growing Ideas

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